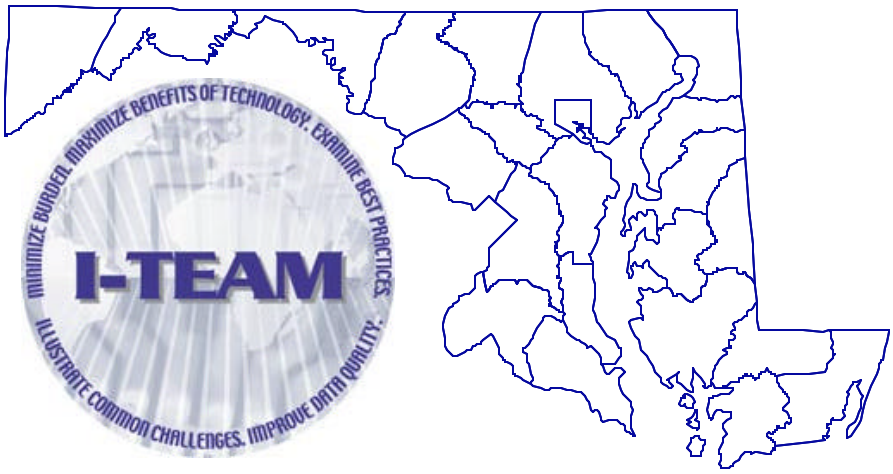
Maryland Geographic Data Implementation Team Plan



Prepared by
the Maryland State Geographic Information Committee

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(Approved DRAFT)

(Proposed Smart Growth Data Improvement Act of 2002)
MSGIC 003 - 072601

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1.0 EXECUTIVE SUMMARY

Managers make good decisions by acquiring accurate information, taking input from diverse sources, engaging in fruitful discussions and generating consensus solutions with all affected parties. Geographic information are important to the decision-making process because they allow us to visualize the options and results. They also help us diffuse the impact of misinformation and effectively deal with the damage it does during the decision-making process. Existing geographic information systems (GIS), have already given Maryland decision-makers significantly improved capabilities to implement Smart Growth, Priority Funding Areas, Green Print, Rural Legacy and other key planning efforts. In addition, these systems are vital to managing such diverse fields as law enforcement, emergency services, public works, health care, agriculture, environment and natural resources management. To promote intergovernmental coordination and better prepare Maryland Executives to manage in the coming decades, we must begin a map modernization program that lays a new foundation for future data management systems. That program is the proposed **Smart Growth Data Improvement Act of 2002** which will provide the appropriate infrastructure and budget to ensure that required information tools are available when needed.

We live in an information society that constantly collects data to support management requirements. Without effective coordination mechanisms, government agencies and private business will produce similar types of data that yield inconsistent answers. Collecting similar data many times is a costly mistake that must be avoided and the lack of a consistent and trusted information source allows government and business executives to make divergent decisions.

Effective coordination has been hampered by unreliable operating budgets that are impacted by the economy and changing priorities. Government agencies can not assure each other that particular data collection activities will proceed. Therefore, if certain data are critical to one level of government, they will continue to produce their own data irrespective of other efforts. Modern GIS systems are consistently providing 2:1 benefit/cost ratios for mapping, 4:1 ratios for agencies that use spatial data for analysis, and higher returns for interagency systems. Investments in spatial data provide a positive return and are a good investment in Maryland's economy.

Since 1991, the Maryland State Geographic Information Committee (MSGIC) has coordinated data production of State agencies with geographic data holdings. During that time, little duplication has occurred within State Government. GIS technologies are now in used by every political sub-division of Maryland government and we must provide new coordination mechanisms for data production to meet the "vertical" needs of **all**

government agencies. We must also produce the next generation of large scale, intelligent map products to meet the needs of all users, including private business.

Two unrelated events helped to create a proactive environment in Maryland that will address the mapping needs of all users. At the national level, the White House Office of Management and Budget proposed a new initiative referred to as Implementation Teams. The I-Teams were established to provide a framework for interagency cooperation. At the state level, MSGIC reorganized in April 2001 to enroll a more diverse membership that represents all sectors. The new Committee will help coordinate data producers and manage the Implementation Team, however, full time staff and an appropriate operating budget are required to modernize Maryland's mapping systems.

This plan is the product of Maryland's sixty-three member (and growing) Implementation Team. It provides a comprehensive view of data requirements, production costs and data coordination issues that will allow Maryland executives to make the right decision regarding the proposed Smart Growth Data Improvement Act of 2002. The Technology Services Procurement, approved by the Board of Public Works on April 18, 2001, laid the foundation for coordinated procurement of geographic data and services.

MSGIC proposes the creation of an oversight office for GIS data production referred to as the Geographic Data Partnership Office (GDPO). The GDPO will be capable of building annual data production partnerships that are minimally valued at $12,000,000.00 per year by using $7,000,000.00 in State funds. Following established benefit to cost ratios, the work of this office will provide up to $50,000,000.00 in positive economic impact for Maryland on an annual basis. The I-Team recommends placing the GDPO at the Department of Budget and Management's Information Technology Office, the new Office of Smart Growth, or within the University of Maryland System. The GDPO will work between local, state and federal government agencies, and will have the authority to work with utilities and the private sector to forge true partnerships for data production.

The foundation of geographic data produced by these partnerships will include the essential elements for effective governance in the 21st Century. They will allow us to realize the full potential of Smart Growth while attracting appropriate economic development and providing exceptional services to all Maryland citizens. The remainder of this plan details the infrastructure, budget and data required to do this.

2.0 WHY GEOGRAPHIC DATA ARE IMPORTANT

Over eighty percent of the data that government agencies manage have a geographic component, meaning that they can be related to a physical location on the face of the Earth. Federal, state and local government agencies have produced many of their data in geographic information system formats for over 25 years to "map" those data and show their relationship to other features. These data are used in many ways to support management and planning programs. The following examples provide a brief glimpse of the many uses of spatial data.

2.1 - Governor Parris N. Glendening effectively used spatial data to demonstrate the dramatic growth of the Baltimore/Washington corridor and gain support for the Smart Growth Initiatives. The University of Maryland and the U.S. Geological Survey created the first "red tide" images during a two year million dollar program. Figure 2.1 shows a similar "red tide" image created by using MdProperty View, the parcel mapping system developed by the Department of Planning. This product was created in less than one hour at no cost.

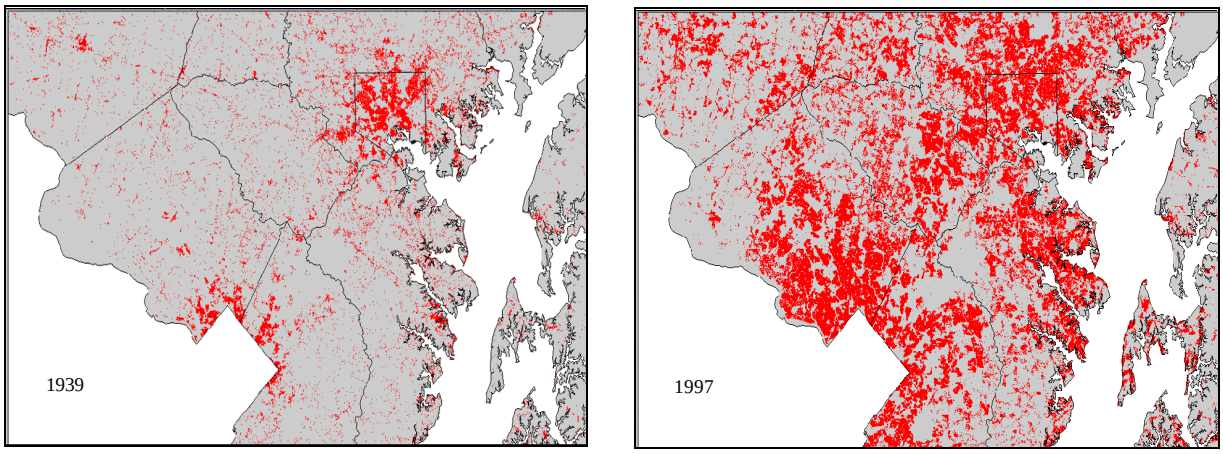
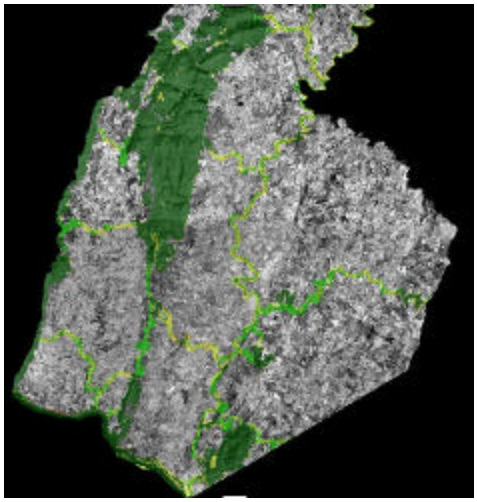


Figure 2.1
Increase in Urban Developed Lands 1939 - 1997
Washington to Baltimore Corridor

2.2 - Priority Funding Areas are mapped by the counties according to criteria outlined in the 1997 Smart Growth Act. The Department of Planning is charged with evaluating and commenting on these maps in light of these criteria. The criteria require that development be of a minimum density and that it be on central sewer. In addition, there needs to be a reasonable relationship between growth supply (growth capacity) and demand (projected growth). Data from *MdProperty View* is overlaid with county zoning, sewer service, land use, protected lands, and other data to develop a geographic database for MDP's analysis of these maps.

2.3 - The Department of Natural Resources used its existing inventory of spatial data with data produced by other agencies to develop the "Green Print" program and to map the infrastructure



of green corridors and hubs to connect and preserve Maryland's natural areas. The data are now used to screen parcels for acquisition under the program. See Figure 2.2 at left.

Figure 2.2
Green Print Corridors and Hubs over
SPOT Satellite Imagery of Frederick County

2.4 - The Department of Planning is the custodian of the State's parcel maps, also known as tax maps or property maps. MDP assembled CD-ROM products containing digital versions of these maps, formatted for use in GIS, along with parcel data, land use/ land cover data, priority funding areas, roads and census geography. State and local government agencies, as well as non-profit organizations and private sector organizations, are able to perform detailed land use analyses using this common tool.

2.5 - Maryland's Rural Legacy Program is part of the Smart Growth Act. It provides funds for targeted land preservation to ensure that areas with exceptional resource value or unique character are preserved. The Departments of Planning and Natural Resources use *MdProperty View and MERLIN Online*, respectively, with other data as outlined in the Smart Growth analysis above, to determine how fragmented the landscape is, how protected from development it is, and to help target areas for preservation. For example, mapping recently developed (or improved) parcels on smaller lot sizes is a good way to illustrate fragmented land. Mapping large undeveloped parcels (e.g., 100 acres or greater) helps to illustrate areas where preservation should be targeted. This analysis provides a good inventory of parcels based on size, zoning, protection status (e.g., easements and parks), and development status.

2.6 - The State successfully partnered with the Mellon Foundation to acquire 58,000 acres of valuable natural resource lands from the Chesapeake Forest Products Company in a complex transaction that required rapid assessment of more than 600 Chesapeake tracts distributed over five counties on the lower eastern shore. The Department of Natural Resources used GIS to quickly identify significant resources on these lands and bring the negotiations to a successful conclusion.

2.7 - Similar to the Rural Legacy application above, the Department of Planning works with several counties to evaluate the effectiveness of their rural zoning and related rural preservation efforts. This type of analysis uses *MdProperty View* to provide maps and tabular data on the size, density, location, frequency, and date of development in rural areas. It also shows large contiguous tracts of land with little or no development. Easements and parks are often mapped with these data to give a better picture of how the different components of rural preservation relate to each other. Output from this work provides clear information on rural development

trends and how future development could impact rural areas.

2.8 - MDP utilized the PFA data and the data within MdProperty View to construct a web-enabled application that will help facilitate the implementation of the Governor's Smart Growth initiative. Users simply enter in an address or parcel account ID and a map will appear showing the subject property in relation to the priority funding area. Alternatively, users can zero in on any individual parcel and with the click of a mouse, obtain information about that property.

2.9 - On April 7, 2000 approximately 110,000 gallons of oil spilled into Swanson Creek and the Patuxent River when a pipeline supplying a major power plant ruptured. Field crews needed detailed maps of the area with inventories of natural and cultural features to do their jobs. The Department of Natural Resources (DNR) supplied aerial photography and maps showing wetlands and sensitive species locations, as well as maps of historic and archeological features and property ownership using data produced by DNR, the Department of Housing and Community Development and the Department of Planning.

Figure 2.3
Aerial Photo of Oil Spill in Swanson Creek

Figure 2.4
Storm Drain Outfall Mapping

2.10 - Montgomery County's GIS Team developed a land evaluation application that allows Agricultural Preservation staff to quickly obtain values of land parcels targeted for preservation, including soil type, topography, land use, etc. in less than 15 minutes. Previously, manual procedures required 8 or more hours per parcel. GIS was instrumental for Montgomery County to receive $8.55 million in Rural Legacy funding during FY98-01.

2.11 - The Office of Geographic Information Systems worked with the Bureau of Water Resource Management to complete the Source Identification and Outfall Characterization sections of Carroll County's Part 1 National Pollutant Discharge Elimination System (NPDES) permit. Staff from both agencies reviewed over 10,000 engineering drawings and conducted field investigation efforts to identify, map, and characterize over 1,000 storm drain outfalls across the county. The County's GIS was used to determine geographic coordinates for all 1000 + outfalls, drainage areas, and land uses within each drainage area for ninety-nine major outfalls being focused on in Part 1. A complete set of detailed maps comprising the data was prepared and submitted with the application. Completing this work in-house using the County's GIS saved Carroll County an estimated $100,000 in consultant fees. See Figure 2.4 above.

2.12 - The Howard County Public Safety System begins with 911call-takers and dispatchers using interactive map displays to verify calls and to route responses. All calls are geographically located as they are received. Police and Fire analysts use this information with GIS tools for planning new facilities and analyzing crime trends.

2.13 - The Howard County Bureau of Highways uses GPS and GIS to coordinate snow removal efforts during a snow event. GPS units and sensors on snow plows provide real-time data to a map display showing roads plowed, and when they were plowed. The map and data are available to users through a web-based tool.

2.14 - The Howard County GIS Division provides data, mapping and information to GIS users through an Intranet web site that provides casual users a wide range of data and allows creation of simple maps. Sophisticated GIS users can download data for their own desktop analysis.

2.15 - Citizens of Howard County use GIS to view subdivision status in the County development approval process. Interactive maps are integrated into the County's public web site, www.co.ho.md.us, with an easy to use interface.

2.16 - The Baltimore City Collaborative, with assistance of numerous organizations and agencies, has mapped child and family socioeconomic and health risk indicators at the Census tract level. These data strategically target high-risk areas with preventive child program resources, and will allow future monitoring of program effectiveness for influencing risk factors.

2.17 - Baltimore County's Comprehensive Rezoning uses a customized ArcView GIS interface to provide planners and decision-makers the ability to query, display and track zoning issues. Current zoning can be overlaid with parcel data, and the application permits analyses of current zoning, proposed zoning changes and tracking of zoning issues. Planners can also produce mass mailings to citizens, locate zoning signs, and digitize zoning changes.

2.18 - Baltimore County's *LACQuire* system automates retrieval, query and reporting of assessment data for the Land Acquisition Unit. New capabilities include parcel selection, attribute query, data retrieval from assessment layers, creation of assessment forms, Titles and Appraisal forms, letters and mailings.

2.19 - Few events better demonstrate the need for close coordination between all levels of government and the private sector than a hurricane. The photographs and captions for Figures 2.5 through 2.10, demonstrate how we all rely on geographic data to respond to such an event. It is important that all levels of government and the private sector work with each other to pre-plan for such events. Routine operations also require the use of geographic information to be effective. Over 80% of government data has a geographic component (e.g. address, zip code, parcel map reference, etc.) that can be mapped using visualization tools.

Figure 2.5 Federal weather forecasters track and relate the location of storm events using geographic data. They are able to make predictions on the areas that are likely to be hardest hit.

Figure 2.6 Government agencies preplan for storm events based on geographic data. They need to know what areas will be inundated after a storm event and be ready to provide guidance to emergency services personnel about where people live and where they are likely to congregate after the event.

Figure 2.7 Emergency dispatch personnel working within city, county and state offices need to coordinate the location of their resources and personnel with the location of events and the people who are in need of services.

Figure 2.8 In a large disaster event, emergency services personnel are brought in from distant areas to assist local crews. These emergency responders are generally unfamiliar with the local area and need the assistance provided by map products to respond to citizens in distress.

Figure 2.9 Emergency coordinators have to preplan and map effective escape routes which are dependant on elevation data. In addition, they have to coordinate and track the movement of people to shelters which are pre-determined in preplanning exercises prior to the events.

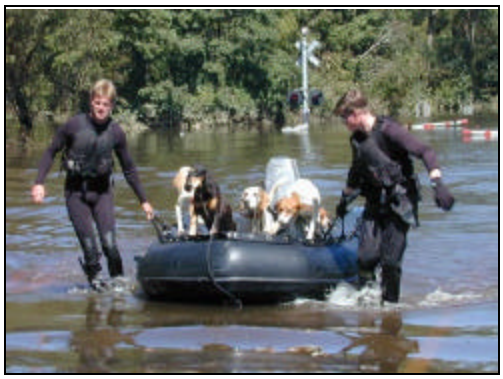


Figure 2.10 Emergency coordinators deal with many unforseen activities. This example shows a relief group which is determined to collect stranded pets. These animals have to be marked with their approximate pick up locations and reunited with owners who have to be "tracked" after a storm event. Providing these groups with appropriate map resources is a tremendous coordination tool and a goodwill gesture.

Photo Credit: All photos in Figures 2.5 through 2.10 were obtained from the State of North Carolina and the Federal Emergency Management Agency Web Site.

3.0 THE NATIONAL SPATIAL DATA INFRASTRUCTURE AND THE WHITE HOUSE OFFICE OF MANAGEMENT & BUDGET'S IMPLEMENTATION TEAMS

The single most important document that regulates Federal agency mapping activities is OMB Circular A-16 which has been in effect since 1953. Circular A-16 is undergoing revision during 2001 to reflect Federal activities related to the National Spatial Data Infrastructure (NSDI). The purpose statement of the draft Circular A-16 states *"This revision describes the National Spatial Data Infrastructure (NSDI) as the technology, policies, standards, financing, procurement, human resources, and related activities necessary to acquire, process, distribute, use, and archive spatial data (e.g. information and process discovery, publishing data, publishing symbol libraries, query filtering, data fusing, earth imaging, photogrammetry, location processing, and spatial analysis). The NSDI will serve the interest of the Federal government and the nation by promoting public and private partnerships, assuring broad accessibility of spatial information through the Internet and other avenues and through emphasis of data standards that are independent of scale."*

The White House's Office of Management and Budget (OMB) began a new initiative in July 2000, to complete the framework data that comprise the National Spatial Data Infrastructure (NSDI). A document titled *"Implementing a New Paradigm*" (Attachment A) was developed by OMB in response to an increased awareness within Federal agencies that accurate spatial data is a fundamental tool for governance in the 21st Century. In this document, OMB is calling for individual states to create "Implementation Teams" (I-Team) to foster the development of framework data within each state. OMB is offering assistance to state governments through assignment of a Federal Partners Team, a Financing Solutions Team and a Technology Assistance Group to work with each I-Team.

The following is excerpted from a publication titled Framework Introduction and Guide that was written by Rebecca Somers and published by the Federal Geographic Data Committee in 1997. *"The framework is a collaborative effort to create a widely available source of basic geographic data. It provides the most common data themes (that) geographic data users need, as well as an environment to support the development and use of these data. The framework's key aspects are:*

- *seven themes of digital geographic data that are commonly used;*
- *procedures, technology, and guidelines that provide for integration, sharing, and use of these data; and*
- *institutional relationships and business practices that encourage the maintenance and use of data.*

The framework represents "data you can trust" - the best available data for an area, certified, standardized, and described according to a common standard. It provides a foundation on which organizations can build by adding their own detail and compiling other data sets."

The seven layers of the framework are Elevation/Bathymetry, Hydrography, Geodetic Control, Cadastre, Transportation, Governmental Units, and Orthoimagery. Maryland has a long history of developing and using framework layers to help accomplish the mission of state government. In addition, many Maryland counties have significant GIS operations. Some use data produced at

larger scales to meet county needs, while others rely on the products produced by state and federal agencies. Spatial data clearly improves the efficiency of government agencies and has played a significant role in Maryland's implementation of highly acclaimed planning efforts such as the Smart Growth Initiatives. Having access to suitable spatial data products has also aided the acquisition of large tracts of land for environmental protection strategies. In addition, it serves as the backbone of "high-tech" initiatives such as the CHART Center at the Department of Transportation.

Those familiar with the application and use of spatial data products have recently been fond of saying **"You can't have e-Gov without g-Gov"**. These individuals know that we can not fully implement e-Government unless we are first able to implement Geographic Information System (GIS) technologies to their fullest extent. The vast majority of government data (generally estimated at 80%) can be used more effectively when it is managed in a spatial or geographic context. It also has much greater value to the public in this form.

The I-Team initiative provides an ideal opportunity (at precisely the right time in Maryland) for state and local government agencies to work together on the next generation of framework layers to provide a consistent large scale product across the entire state. Federal, State and local government agencies worked to develop a new strategic plan for GIS implementation in the State. Part of our shared vision is a new framework comprised of seamless 1:2,400 scale layers. It is more cost effective and logical to produce uniform 1:2,400 scale data products to meet national standards, and to generalize them where appropriate, than it will be to redevelop the existing array of scales and data to meet national standards. As data production prices continue to fall, new products can be created for the cost of reworking existing data. In addition, most observers agree that the general demand for spatial data has moved to 1:2,400 scale products in Maryland to support the needs of County and municipal governments, the private sector and utility companies.

4.0 MARYLAND'S IMPLEMENTATION TEAM

The Maryland State Government Geographic Information Coordinating Committee (MSGIC) and the Maryland Local Government GIS Committee (MLOGIC) held a joint quarterly meeting on October 25, 2000. The members of MSGIC's Database and Resource Development subcommittee discussed the I-Team initiative and agreed that Maryland should forward a plan to the Federal Government for consideration and approval. The full MSGIC Committee agreed to this action during their afternoon session and the Executive Committee has met and approved this project. The following table lists the members of Maryland's I-Team which is intended to be a public/private partnership.

Table 4.1
Maryland's Implementation Team

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5.0 ISSUES DISCUSSION

This proposal is simply a starting point for the discussions required to implement a statewide large scale mapping program in Maryland. Maryland has a long history (>25 years) with digital mapping programs and there are many policy issues that must be revisited. An executive forum must be convened to complete work on the final proposal. This document is designed to clearly identify the issues and allow an informed discussion to ensue. The issues identified in this section will need discussion and resolution by Maryland's policy makers and executives.

5.1 The National Spatial Data Infrastructure (NSDI), the Digital Earth Program (DEP) and the National Map Program are built on the premise that the majority of spatial data are in the public domain and freely accessible across Internet. The NSDI is built on a rigid set of standards published by the Federal Geographic Data Committee (FGDC) to ensure compatibility of data across the nation. The DEP program (see Appendix B) is an ambitious undertaking that plans to bring together disparate data types from all available sources. NSDI, DEP and the National Map will likely be more efficient when data types are produced to the existing federal standards. Maryland will have to decide its level of participation and compliance in these important programs. This is especially true, given the fact that Maryland intends to work at larger scales than the existing NSDI standards.

5.2 Federal and State Interest in 1:2,400 Scale Mapping are not assured. Federal agencies normally don't have an interest in mapping at this large scale and their participation in the NSDI is built on a foundation of 1:12,000 to 1:24,000 scale products. They have recently shown interest in larger scales, however, and have tentatively offered to fund a portion of New York State's large scale orthophoto program. Maryland State government agencies ocncur that 1:2,400 scale mapping is required to form effective partnerships with local government. The Maryland Department of Planning suggested that the State should consider mapping the Priority Funding Areas (PFA's) at 1:2,400 scale to implement the provisions of the Smart Growth Initiatives while mapping the remaining areas of the State at 1:4,800 scale. The PFA's comprise about 26.5% of the area that needs to be mapped throughout the State. They are most heavily concentrated in the metropolitan counties, but there are PFA's in each Maryland county (Refer to Table 9.1 in Section 9). Other agencies such as the Department of Natural Resources, Department of Transportation, Department of General Services and Maryland Environmental Service will benefit from mapping at 1:2,400 scale to assist in managing their facilities which are located throughout Maryland. In addition, the State Police have previously expressed an interest in large scale mapping to assist them in accomplishing their mission.

It is clear that county governments prefer mapping at 1:2,400 scale to effectively provide county services and manage their operations. Although there may not be a clear Federal or State interest in mapping <u>all</u> areas at 1:2,400 scale, it will be required to form effective partnerships with county government agencies and gain their support for this project. It has been suggested that we map at variable scales depending on the area (e.g. absence or presence of PFA's). Both New York State and Tennessee have already begun variable scale mapping programs that are well documented. Maryland needs to refer to the work already done by these states.

The most critical issue is compatibility across jurisdictions. We currently have county, state and federal agencies mapping the same features at different scales and possibly developing different answers to the same questions. For example, Norway recently announced that the measured

length of their shoreline had increased by 45% after they created a larger scale and more accurate map of the Country. While there are actually some distinct benefits associated with having a variety of map products, we will benefit significantly if all agencies use the same data to make decisions and manage their operations. Further discussion on required and/or variable scales will be necessary, and the end result may be the use of variable scales.

5.3 Licensing, Copyright and Data Charges are important public policy issues that need to be revisited in Maryland to ensure compatibility with the NSDI, DEP and National Map programs. Currently, Maryland uses the authority found in State Government Article 10-901 through 10-905, inclusive (Appendix C), to copyright and license spatial data products, and to charge for the cost of their distribution. In the past, custodians of spatial data products have been directed by the Governor's Office to recover costs of data distribution to help offset the high cost of production. In order to do this, and to prevent liability issues for the State, the Attorney General's Office has directed data custodians to copyright and license their products. A standard license agreement (Appendix D) was developed to ensure consistent licensing practices.

Data custodians have worked closely together through MSGIC to ensure the public has reasonable and fair access to state-produced data products. Some custodians are concerned that the current policies prevent effective sharing of data in limited cases and certainly result in lost opportunities for partnerships. In addition, the data producing agencies must divert staff to deal with the public on sales which do not generate significant revenues.

5.4 Licensing Data from the Private Sector is an issue that will also require further discussion. Maryland agencies typically support their individual missions through the production of spatial data. Since they do not produce these products for the sole purpose of distributing them, licensing privately produced data becomes an attractive option for the agencies. To date, some State agencies have negotiated the acquisition of private data to include favorable terms that allow sharing between State agencies and local government, and they have ensured that the data products could be viewed across Internet without downloading the actual data. This last provision supports public access to information regarding decisions that affect them. State agencies have not negotiated rights to share these data with the federal government or non-profit organizations.

Licensing data from the private sector is an attractive option, because it can significantly decrease the acquisition time and cost of the products. The products are readily available from private sector vendors for other entities that wish to license these products. However, licensing of products by the public sector may decrease the utility of the NSDI, DEP and National Map programs, because many public end users are simply not willing to pay the licensing fees. Therefore, we must question if the Implementation Team and Maryland policy-makers have more of an obligation to the taxpayer to minimize the expense of acquiring spatial data, or to fully fund data acquisition for the benefit of all public interests?

5.5 Funding Models for Spatial Data Production have always been problematic in Maryland and elsewhere. It is sometimes difficult for policymakers to understand, or justify, the enormous costs associated with spatial data production, because they seldom see the direct use or value of the products in everyday decision-making activities. It is also difficult for data custodians to articulate the future uses for spatial data, because applications are constantly being built around new data as it is made available. These future applications are not apparent and their cost/benefits are difficult to determine. We do have excellent anecdotal examples of how 10-year old planning

efforts to produce spatial data have just recently provided significant returns during implementation of the Governor's Smart Growth Initiatives, State acquisitions of large land tracts, and development of high technology applications (See Section 2).

Maryland State government agencies have coordinated data production through MSGIC. To date, the individual agencies have each justified and funded the particular data required to meet their respective missions. Agencies depend on general and special fund appropriations for their operating budget with few enhancements to conduct mapping programs. They frequently use federal grant programs to increase production rates. This has resulted in very slow production and if we continue to fund data production through these methods, it is unlikely that the State could realistically enter into effective partnerships to create a map base for the entire State at 1:2,400 scale. In addition, mapping small areas is much more expensive than mapping large areas on a cost per square mile basis. The advantage of funding data production by the existing method is that the individual agencies place a high priority on production of data required to meet their mission and will aggressively "fight" for, or defend the appropriation. Other states (e.g. Ohio and Virginia) have relied on large appropriation requests for a central GIS coordination office to fund data production. This method frequently results in the loss of the appropriation and stoppage of the mapping programs. When budgets become tight due to decreasing revenues, mapping programs typically become easy targets because they have large appropriations with few positions attached. In addition, when law makers and budget analysts are not keenly aware of the benefits of a "spatial data infrastructure" they are not likely to support large appropriations for data production.

The above discussion clearly points to the need for a paradigm shift whereby spatial data is considered a capital asset of government instead of an operational expense. The use of spatial data products has become pervasive in government programs and will continue over the next decade at significantly increasing rates. The need for spatial data by government agencies and the public is already as fundamental as their need for office buildings, computers, roadways and public lands. Previously, it has been thought of as a "temporary asset" that has value for a short time and then becomes worthless. We now clearly see that spatial data has a permanent value as a historical record which in the future will allow us, among other things, to determine ownership of land at a certain point in time, or determine growth patterns that have led to lost environmental quality.

The following information is excerpted from Summary Proceedings of the Geospatial Information Roundtable which was held on July 18, 2001, in Washington, D.C. "The FGDC should invite the spatial data community to quickly establish a Financing Solutions Team (Financing Team). The purpose of the Financing Team is to work with Federal agencies, States, regions and tribal areas, and the private sector to identify and develop intergovernmental and public-private financing capabilities to support the NSDI and the implementation strategies of the Teams or Consortia. The Financing Team should include representatives from Federal and State governments, financial institutions, professional organizations, academic institutions, and non-profit organizations. The Financing Team should help build a business case for the NSDI that would justify funding from legislative bodies and financial markets. The Financing Team should identify and evaluate alternative ways to align the present stove-piped legislative appropriation process. It should help develop the evidence to assist Federal agencies and States collaboratively fund (and explain to their separate appropriations sources the reasons for funding) spatial data infrastructure investments yielding interagency and intergovernmental benefits and economies of scale. It should explore ways to align and leverage interagency and intergovernmental geospatial capital planning and budgeting processes through memoranda of understanding or other cross-cutting arrangements that incorporate common investment criteria and consortia that responsibly maximize the efficiency and

effectiveness of shared information. The Financing Team should advise and support the efforts of the Teams or Consortia and share knowledge gained. The FGDC should work together with Federal agencies and States in an effort to establish a mechanism for developing and sharing econometric case studies regarding shared investment in spatial data assets and decision support tools."

6.0 PROPOSED MAPPING SYSTEM AND BENEFIT/COST FACTORS

No rational decision can be made on implementation of a mapping program without an evaluation of the options and the benefit/cost ratios. The Team reviewed the following options and considered the cost and benefits of implementing this program.

6.1 Design Options - The Implementation Team discussed several design options for a statewide framework layers mapping program, including uniform 1:12,000 scale products, opportunistic random scale products, variable large scale products and a uniform 1:2,400 scale product. The uniform 1:2,400 scale product was agreed to early in the process. The next four sections provide a succinct statement regarding each option.

6.1.1 Uniform 1:12,000 scale products (Rejected) - This option would be entirely suitable for state and federal government agencies. It is useful for local governments in the absence of larger scale products, but local governments continue to move to 1:2,400 scale products to support their missions. This means that we must support larger scale products to form effective partnerships with local government.

6.1.2 Opportunistic Random Scale Products (Rejected) - In essence, this is the system we use today. Products range in scales, because they are funded for a specific purpose and not with the intention of integrating into a cohesive mapping program. This results in numerous "fit" issues that degrade the overall usefulness of the maps to the smallest scales. This option results in lost opportunities to effectively partner.

6.1.3 Variable Large Scale Products (Rejected) - This option was initially rejected but may be revisited for further consideration as the I-Team continues deliberations in the Regional Action Teams. It was estimated that mapping at multiple scales would increase costs, because each different scale has to treated as a separate project. The original concept was to map developed areas at 1:2,400 scale while mapping remaining areas as a smaller scale, possibly 1:4,800.

6.1.4 Uniform 1:2,400 scale Products (Accepted) - The I-Team endorses a uniform 1:2,400 scale mapping project across the entire State. For a variety of reasons, a uniform product is easier to manage than multiple scale products. This scale of mapping is clearly the choice of county agencies and while it is not ideal for municipal governments, it will provide a reasonable product for those cities that have not yet invested in the extremely large scale products they desire. This recommendation is for the "Framework Layers," which include property maps, transportation features, political boundaries, water features, geodetic control, elevation and ortho imagery. This program will build a "solid foundation" for all future mapping efforts in Maryland. It is not feasible, nor appropriate, to map all desired layers at 1:2,400 scale. For example, it could cost up to $350,000,000 to map geology for the entire State at the selected scale. This level of detail is only required for major construction projects at specific locations.

6.2 The Value (Benefit/Cost) of Spatial Data - In past years, it was difficult to demonstrate Benefit/Cost ratios for implementation of GIS systems and production of spatial data.

They were required, however, and we now have a great deal of literature to cite. Also, now that the technology is better understood, there is less demand for this information, because executive decision makers see (first hand) the value of these systems. Regardless, we should be clear about the value of spatial data.

6.2.1 Benefit/Cost Ratios - The following information was taken from the GIS World article that appeared in the July 1996 issue titled, *"Weighing GIS Benefits with Financial Analysis" by George Korte.* It is the most frequently quoted source on benefit/cost ratios for GIS. The article provided brief descriptions of several projects and presented a detailed benefit/cost (B/C) analysis of several projects, including the following findings for B/C ratio of a GIS:

1) A digital system used only for computer-aided mapping and updating gives you your money back (B/C 1/1).
2) If the system is used for planning and engineering purposes, your money will be doubled (B/C 2/1).
3) Research reports published in Norway and Sweden show that the B/C ratio for automating conventional maps is greater than three times your money back (B/C 3).
4) If you manage to create a common system in which information can be shared among the different relevant organizations, you will regain investment by four times (B/C 4/1).
5) For organizations with a poor system for manual map production, automated systems have given B/C ratios up to 7/1.

6.2.2 Benefits of Spatial Data and Geographic Information Systems - Benefits are generally put into the following categories. Direct Benefits include operational efficiencies such as a reduction in staffing levels or staff time to accomplish the same work task or an increased work load. An example of a direct benefit is that the City of Philadelphia used GIS in 1995 to optimize their garbage truck routes, allowing them to save $1,000,000.00 in overtime costs the following year. Government-wide Benefits include the value of having better information to make management decisions. An example of this occurred in Scottsdale, Arizona, when the City mounted a challenge to the mid-decade census in 1996, resulting in increased per capita revenues to the City of $1,800,000.00 million per year for five years, totaling $9,000,000.00. External Benefits are generally intangible and include such things as the public saving OR protecting an archeological structure or an endangered species, because the government mapped its location and distributed the information.

7.0 OPTIONS FOR IMPLEMENTING RECOMMENDATIONS

I-Team members discussed several options for funding and managing data production. A repeatable 1:2,400 scale mapping program is an ambitious undertaking on a statewide basis. It will take the collective resources of municipal, county, state, regional and federal agencies working **with** utility companies and others in the private sector to accomplish the desired results. Doing this will require a great deal of coordination and a **reliable** government funding source that can be used to form partnerships and respond to grant opportunities that require a funding match. It will also require that an appropriate unit be empowered to "broker" partnerships on behalf of all data partners.

Team members focused on four options to implement this program, including status quo, private financing/licensing, a data cooperative and creation of a new data coordination office. The I-Team supports a new data coordination office based on its deliberations that are summarized below.

7.1 Status Quo - In the past, the MSGIC Database and Resource Development Subcommittee has coordinated data development between state agencies. The new organization will have the ability to coordinate between a larger community, but there is no mandate for the parties to work together.

The level of coordination and work required to implement a large scale mapping program is significantly greater than past activities. In addition, the existing GIS coordinators in each agency simply don't have more time to spend on coordination activities because their workloads are constantly increasing. It may be feasible to continue improving attribute quality through development and promotion of better standards, but coordinating large scale data production using existing staff and resources will not be possible. It would take an unacceptable period of time to produce the first products and maintenance would not be completed. Problems inherit with this approach include:

- The task is enormous and beyond the current capabilities of state agencies to coordinate.
- Without a central budget and "authority" it will be difficult to coordinate multiple groups to take advantage of existing activities and funds.
- Doing "piece-meal" data production in small areas will be **much** more expensive and will take an inordinate amount of time that will be unpalatable to the partners (perhaps as long as 20 years).
- Agencies have competing standards & requirements for GIS data because there is a lack of common standards for large scale mapping. It will be difficult to get consensus from multiple partners that do not "have" to work together.
- This activity will lead not help to gain data parity between all governmental units.

Coordination of large scale data production through the MSGIC Committee is not favored by the I-Team.

7.2 Private Financing and Licensing of Data - Private companies offer a variety of private financing options for development of spatial data. One option is to privately finance data production for a particular entity (agency or group) and then enter into a long term agreement to license the data on an annual basis. The private entity usually licenses the data for a fee that is significant, but lower than the actual production cost. The private company maintains ownership of the data and the right to resell it to other users. A second option is financing production of standard spatial data products

for general sales. This is becoming more popular and many government agencies license this type of data. The major problem with this option is that there has to be a business model that allows the private sector to recover the cost of data production and make a profit based on expected sales. For this reason, privately produced spatial data products are only available in metropolitan areas. Many other options and variations exist. Problems inherit with this approach include:

- Some data sets are inherently valuable to governmental entities and will have limited appeal to private investment.
- The dynamic nature of the market place may place some long term arrangements at risk, companies may choose to stop offering data or terms and conditions may change. Users must perform ongoing research to locate different sources of data and shop for the best value.
- How much liability will the different partners be willing to accept. Who will have the ultimate liability for the data and does sufficient legal precedent exist to create a model for this type of relationship.
- Who within each organization will be authorized to enter into agreements regarding the lease or license.
- What works in one County may not work in another. Some geographic areas may have multiple licenses while other areas may only be able to afford a single license. Data costs will be uneven across different areas.
- License agreements generally tend to restrict State government entities from distributing data.
- To support a state-wide program, MSGIC or some other entity need to act as a lease holder and the data could then be distributed to local government partners. Counties would have to transfer funds to MSGIC, what would happen if a local government entity refused to cost share.

Procurement of large scale spatial data through private funding and licensing is attractive for small areas, but is not recommended by the I-Team for a statewide project.

7.3 Data Cooperative - A GIS Cooperative, including members from public, private and academic organizations could be formed to create a statewide large scale map. A relatively small central coordination body could manage the activities of a cooperative. The objectives of the cooperative are similar to those of the state sponsored approach, which are to coordinate GIS data requirements, define information and technology standards, data production efforts and applications development for the greater Maryland community. However, the primary difference is the reliance on voluntary and mostly non-funded participation.

There are several examples of GIS cooperatives throughout the nation including the New York State GIS Cooperative and the City of Tucson GIS Cooperative. Many of these cooperatives share common goals including:

- Development of policies for data development including data quality
- Adoption of standards for metadata and data transfer
- Development of policies on data access and data security
- Provision for multi-organizational communication and coordination
- Development and support of cooperative funding strategies

GIS cooperatives are typically bound by a Memorandum of Understanding (MOU) or a formal agreement that define how organizations implement joint data development efforts, specify which agency is responsible for which activities and define how they share the ownership or use of the information. These agreements are executed between the cooperative coordinating body and each member of the cooperative with limited liability for each party.

Cooperatives may not always be the most effective means of organization. Problems inherit with this approach include:

- lack of motivation and participation by organizations that are data rich
- prioritization conflicts
- operational costs of the coordinating body

Costs should be nominally lower than the state sponsored approach, but must be stable enough to sustain continuity during fiscal downturns.

A Maryland State GIS Cooperative could potentially be hosted by the MSGIC and funded at a 2-3 FTE level. The remaining funding for coordination activities would come in the form of in-kind contributions from members or seed money from potential sponsors of the cooperative. The I-Team does not favor creation of a data cooperative.

7.4 Creation of a Geographic Data Partnership Office - The Implementation Team recommends new legislation and a budget enhancement for fiscal year 2003 to provide the foundation of this effort. The legislative package will need to be drafted in time to be submitted with the Governor's 2003 Budget. The I-Team suggests that the proposed legislation be titled **"Smart Growth Data Improvement Act of 2002."** This activity will have far reaching benefits to all Maryland municipalities, counties, state agencies, federal agencies and regional governments. It will bring parity to all government agencies that currently have very disparate data holdings, allowing them to participate as equal partners in all inventory, planning, and implementation activities. This program will also have a very positive economic impact on utility companies, the private sector and Maryland's citizens. Problems inherit with this approach include:

- This will look like "just another state agency here to help us."
- Funding levels will be disparate between the various partners.
- Without qualified and talented staff this program may flounder.
- A significant budget cut, or dissolution of this office would have disastrous impacts on municipal, county and state agencies.

8.0 GEOGRAPHIC DATA PARTNERSHIP OFFICE (GDPO)

Coordination of spatial data production in Maryland will require varying levels of liaison activity with every municipality, county, state and federal agency operating in Maryland. In addition, all utility companies operating in the state and many private sector businesses (e.g. engineering and real estate firms) will have a keen interest in spatial data production and are likely partners. This formidable task will require staff who are both experienced "networkers" and intimately familiar with contracting and managing spatial data assets. The Implementation Team recommends that an office be established at one of the following locations. 1) The newly created Governor's Office of Smart Growth, 2) The Office of Information Technology at the Department of Budget and Management, or 3) at a location (to be determined) within the University of Maryland System.

8.1 Role of the GDPO - GIS operations offer a powerful dimension to their parent organizations. In nearly all cases, these operations are continually assigned additional work to help meet the highest priority missions. While these service functions are clearly useful, they prevent production oriented GIS operations from accomplishing data production. The I-Team is concerned that the proposed GDPO will suffer a similar fate. Therefore, it recommends that the mission of the GDPO be clearly defined as follows, and that an oversight board be established.

8.1.1 Partnership Development and Liaison Activities - The primary function of the Geographic Data Partnership Office will be building partnership arrangements between municipal, county, regional, state and federal agencies. It will also develop strategies allowing it to work with utility companies and private sector businesses. Staying in contact with all these groups will allow the GDPO to monitor opportunities and to match likely partners. This activity is extremely important, because the cost of spatial data production dramatically decreases on a per square mile basis (as much as 90%) as the production area becomes larger. The GDPO will also maintain a well published schedule of data production activities and can use its own operating budget to ensure that more effective partnerships are created.

8.1.2 Grant Management - Many federal grants are available for spatial data production. The GDPO will always have production contacts in place and will have an appropriate operating budget in place to take advantage of grant opportunities. It can provide a valuable service to other agencies by managing these types of federal grants, or working under MOA's with other agencies to produce data to meet a single requirement of a more complex federal grant.

8.1.3 Contract Management - The GDPO will maintain standing contracts and operations for the production of nearly every spatial data type. This will provide for cost effective data production that will benefit every participant. The GDPO staff will be very proficient in contracting for spatial data production and can provide valuable services to other entities. The GDPO should also serve as the focal point for contracting of GIS services under the State's Technology Services Procurement.

8.1.4 Quality Assurance - The GDPO staff will develop and implement data quality assurance standards and procedures to ensure that all contract production meets appropriate standards. It may also manage quality assurance service contracts for data supplied by vendors.

8.1.5 Internet Data Access - The GDPO will maintain a high-bandwidth Internet connection

and FTP servers to distribute all spatial data products. The staff of the GDPO will be responsible for data management to ensure its timely access across Internet.

8.1.6 Physical Data Distribution - The GDPO will be responsible for managing and distributing data on CD-ROM, or other suitable media, to those persons not capable of retrieving the data across Internet. In addition, they will be responsible for ensuring that all data is appropriately forwarded to the State Archives to ensure its future preservation.

8.1.7 Internet Mapping Services and E-Government - In the coming years, spatial data will become increasingly important to E-Government operations. The GDPO will be responsible for coordinating E-Government activities related to spatial data. The Office will establish an Internet Map Service to ensure the public has timely access to all government spatial data products for viewing and reasonable manipulation.

8.1.8 Staffing and Administrative Support for MSGIC - The Maryland State Geographic Information Committee is an all volunteer organization that is focused on the same work as the GDPO. MSGIC needs the approximately 1/2 of an FTE for support of administrative functions related to mailings, minor contracting and web site management. A close working relationship between the GDPO staff and MSGIC committee members will be very valuable.

8.2 Staffing Requirements - The I-Team recommends the following staffing level for the GDPO to be phased in over two years. Seven of the twelve positions will be required for the first year of operation. The remaining five positions can be hired during the second year of operation.

Table 8.1
Geographic Data Partnership Office Personnel Requirements

Quantity	Classification	Year 1	Year 2	Grade	Function
1	Program Manager IV	1		22	Lead the Data Coordination Office
2	Administrator V	1	1	20	Initiate and Manage Partnership Agreements, Contracts and Production
1	GIS Coordinator	1		19	Manager Internet Map Access
1	Administrative Officer III	1		15	Administrative and Budget Functions
1	Office Secretary III	1		10	Secretarial Support
4	GIS Technician I	1	3	16	Data Quality Assurance
2	GIS Technician II	1	1	18	Internet Mapping Application / E-Gov

These twelve positions will cost approximately $527,000.00 for the grades indicated in Table 8.1 using step III salary appropriations to account for hiring issues. Including the 30% fringe expenses for labor requires an approximate total of $685,000.00 for labor expenses. An operating budget (less

data production) of $315,000.00 is suggested for the GDPO, resulting in a total appropriation of $1,000,000.00, not including contractual services. The GDPO could be placed in any of the existing agencies within state government. Likely choices are the Information Technology Office at the Department of Budget and Management, the Office of Smart Growth and within the University of Maryland.

8.3 GDPO Operating Budget - The I-Team recommends that the GDPO be provided with a $6,000,000.00 contractual services budget which is limited to data production and Internet services only. This money will be used to initiate partnership arrangements according to the I-Team plan priorities, and to match federal grant opportunities that arise which are consistent with the goals of the I-Team plan. The operating fund should be able to generate partnership opportunities in excess of $12,000,000.00 per year.

Table 8.2
Approximate Budget Allocation By Data Groupings

Data Theme	FY03	FY04	FY05	FY06	FY07
Digital Elevation Model and Ortho Imagery	$2,000,000	$2,000,000	$2,000,000	$2,000,000	$800,000
Bathymetry					$1,500,000
Political Boundaries	$200,000	$200,000	$200,000	$200,000	$100,000
Hydrography (Stream/River)	$150,000	$150,000	$150,000	$150,000	$150,000
Transportation Features and Road Centerline w/Addresses	$750,000	$750,000	$750,000	$750,000	$750,000
Cadastre (Parcel Mapping)	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000
Land Cover and Land Use	$170,000	$170,000	$170,000	$170,000	$170,000
Smart Growth Package	$350,000	$350,000	$350,000	$350,000	$350,000
Local Master Plans with Water & Sewer and Zoning	$500,000	$500,000	$500,000	$500,000	$250,000
100-year Flood Plain	$300,000	$300,000	$300,000	$300,000	$300,000
Agriculture, Environment & Natural Resource Related Data	$480,000	$480,000	$480,000	$480,000	$500,000
Historic and Archeologic Data	$100,000	$100,000	$100,000	$100,000	$100,000
TOTALS	$6,000,000	$6,000,000	$6,000,000	$6,000,000	$6,000,000

8.4 Oversight of GDPO Operations - It is imperative that the GDPO activities stay focused on data production, quality assurance and data distribution. This group will likely come under intense pressure to perform routine GIS service work for the agency they are assigned to. The I-Team recommends that a five member Oversight Board be created with the following membership; two members appointed by the MSGIC Executive Committee, one member appointed by the Governor's Smart Growth Sub-Cabinet, one member representing a County Government GIS

Office, and one member from a federal agency involved with mapping and GIS. The GDPO Oversight Board shall meet twice annually to review the activities of the GDPO to ensure that they are meeting their obligations under Sections 5.5.1 through 5.5.8. The Advisory Board will also monitor and advise on budget allocations and prioritization of activities.

9.0 DATA PRODUCTION PLAN

9.1 Planning Activities - During the initial planning stages, the Implementation Team has developed approximate costs for completing coverage of each data layer at 1:2,400 scale. Since we have private sector partners on the Implementation Team, we don't want to jeopardize their ability to bid on future contracts for work under this initiative. We are developing a draft plan with approximate costs and product specifications for planning purposes. Most of the information contained in this section comes from existing contracts in Maryland or government agencies in other jurisdictions. Before entering a bidding phase, a select group of individuals will develop the detailed product specifications to prevent a conflict for the private sector partners on the Team.

For planning purposes, we will use the areal extent and other map tiling information located in Table Four for each Maryland County and the State. This information was generated by the GIS Division at the Department of Natural Resources using the following methods. The number of USGS 7.5' map sheets with a portion in Maryland comes from their index book. The number of 3.75' map sheets comes from the DNR orthophoto program. This number excludes map sheets that are all open water and does not include the number of map sheets on the Virginia shore of the Potomac River that have no land mass in Maryland. The land area for each county was calculated from data tables associated with the Department of Planning's 1997 Land Use and Land Cover data for all cover types except water. The total area for each county was calcuated from the same data by including all land cover types. The approximate number of 1:2,400 map sheets was determined by creating a 2000' by 3000' grid and intersecting it with a county political boundary file and excluding areas that were all water. The number of Priority Funding Areas (PFA's) were generated by intersecting the Department of Planning's PFA data with the same grid file. The number of parcels for each county was determined from the latest release of the Department of Planning's MdProperty View. The county totals for several columns in Table Four will not add up to the Statewide Totals, because many map sheets are in two or more counties.

The most appropriate organizational structure to accomplish the proposed mapping programs is to establish Regional Action Teams that will foster development of a consistent statewide product while trying to integrate Maryland's efforts into those of the federal agencies and surrounding states. A Regional Action Team will be established for each of the Framework layers and for other essential data such as Land Use and Land Cover. Each of the Regional Action Teams will be responsible for maintenance of a web page similar to the National Hydrography Data web page located at: http://www.fs.fed.us/emc/nris/water/nhd_lib/index.htm .

Table 9.1
Planning Units for Map Production

County	**# 7.5' Maps**	**# 3.75' Maps**	**Land Area Acres/Square Miles**	**Total Area with Water Acres/Square Miles**	**Approx. # of 1:2,400 Map Sheets Total # / # in PFA Area**	**Number of Parcels**
Allegany	15	46	266,780 / **417**	269,539 / **421**	2,169 / **996**	40,314
Anne Arundel	15	47	265,388 / **415**	379,353 / **593**	2,311 / **1,058**	187,364
Baltimore City	4	11	51,732 / **81**	58,886 / **92**	460 / **457**	233,355
Baltimore County	23	66	384,893 / **601**	441,876 / **690**	3,188 / **1,250**	276,481
Calvert	9	26	137,151 / **214**	220,976 / **345**	1,285 / **294**	37,962
Caroline	15	39	204,739 / **320**	208,611 / **326**	1,665 / **126**	14,810
Carroll	17	47	286,985 / **448**	289,487 / **452**	2,260 / **571**	59,313
Cecil	13	44	222,868 / **348**	270,389 / **422**	1,916 / **399**	41,245
Charles	21	67	294,519 / **460**	414,306 / **647**	2,451 / **483**	51,447
Dorchester	24	67	355,180 / **555**	614,030 / **959**	3,423 / **262**	19,164
Frederick	21	66	424,938 / **664**	427,102 / **667**	3,279 / **923**	79,214
Garrett	18	62	419,576 / **656**	425,060 / **664**	3,251 / **227**	25,814
Harford	15	49	280,668 / **439**	335,285 / **524**	2,329 / **568**	81,695
Howard	10	29	124,813 / **195**	126,177 / **197**	1,297 / **583**	86,020
Kent	15	39	178,479 / **279**	257,434 / **402**	1,592 / **270**	12,511
Montgomery	18	53	317,048 / **495**	324,158 / **506**	2,513 / **1,212**	298,368
Prince George's	19	57	310,038 / **484**	318,785 / **498**	2,479 / **1,575**	258,510
Queen Anne's	19	53	237,588 / **371**	325,850 / **509**	2,119 / **198**	21,843
St. Mary's	20	58	230,794 / **361**	352,580 / **551**	2,146 / **351**	15,984
Somerset	18	50	206,808 / **323**	539,393 / **843**	2,161 / **278**	39,474
Talbot	16	41	171,608 / **268**	301,406 / **471**	1,679 / **349**	18,003
Washington	19	57	293,352 / **458**	298,857 / **467**	2,403 / **527**	51,654
Wicomico	15	43	240,434 / **376**	257,297 / **402**	1,963 / **569**	40,810
Worcester	18	60	301,646 / **471**	433,859 / **678**	2,746 / **351**	54,563
STATEWIDE TOTALS	260	898	6,208,025 / **9,699**	7,890,698 / **12,326**	51,100 / **13,521**	2,045,918

9.2 Regional Action Teams - Taking the production of data from planning concepts to actual production will take significant commitments from diverse committees that will be responsible for fostering development of each Framework Layer. MSGIC will assign a Regional Action Team to each layer with an appropriate designee from federal and state agencies to ensure that regional concerns and federal standards are being addressed. Additional staff for each committee will come from local government, academia (as appropriate), the private sector and utility companies. The Regional Action Teams will be responsible for developing a detailed data profile that can be used to procure data that is consistent over regional boundaries.

9.3 User Needs Assessment

The Implementation Team has identified the following statewide management issues and the data themes required to address each issue. This analysis is summarized in the table below for convenience. The Governor's highest priority programs are identified by **bold text**.

Table 9.2
User Needs

Priority Data Layers / **Maryland's Management Issues**	**Smart Growth**	Economic Development	**Family and Youth Issues**	**Education (K-16)**	Environmental Regulation	Emergency Management	**Law Enforcement**	Natural Resources Protection	Public Land Management	**Electronic Government**	E-911 Operations	Traffic & Transportation	Epidemiology & Health Care	Agriculture & BMP's	**Chesapeake Bay Agreement**	Green Infrastructure	Sea Level Rise & Erosion	Infrastructure Management
Digital Elevation Model	X	X			X	X	X	X	X			X	X	X	X	X	X	X
Bathymetry	X	X			X			X				X			X	X	X	
Ortho Photography	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Political Boundaries	X	X		X	X	X	X	X	X	X	X	X		X	X	X	X	X
Hydrography (Stream/River)	X	X			X	X	X	X	X		X	X	X	X	X	X	X	X
Transportation Features	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Cadastre (MdProperty View)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Geodetic Control	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Land Cover	X	X			X	X	X	X	X		X	X	X	X	X	X	X	
Land Use	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Wetlands	X	X			X	X	X	X	X		X	X	X	X	X	X	X	X
100-year Flood Plain	X	X			X	X	X	X	X		X	X		X	X			X

Critical Area Boundary	X	X			X			X	X			X		X				
Smart Growth Layers	X	X		X	X			X	X			X			X	X	X	X
SURGO Soil Maps	X	X			X			X	X			X	X	X	X	X	X	X
Demographics	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Geology		X			X	X	X	X	X		X	X	X	X	X	X	X	X
Communications	X	X		X		X	X			X	X	X						X
Facilities & Infrastructure	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Wildlife Habitat Areas					X			X	X				X	X	X	X	X	X
Zoning	X	X			X			X	X			X		X	X	X	X	X
Water & Sewer Plans	X	X			X	X		X	X		X	X	X		X		X	X
Historic Properties	X	X			X			X	X			X						X
Archeological Sites	X	X			X			X	X			X						X
Road Centerline/Address	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

10.0 DIGITAL ELEVATION MODEL AND BATHYMETRY DATA PROFILE

10.1 General Discussion: The Department of Natural Resources has been the lead agency for production of Digital Elevation Models to support production of their 3.75' digital orthophoto maps. In addition to this project, the State Highway Administration contracts for production of digital elevation data on a frequent basis to support road development work. The Department of the Environment occasionally contracts for digital elevation data to support flood plain mapping. In addition, several counties have contracted for production of digital elevation data using similar specifications to the product suggested below. The Implementation Team supports remapping the State every five years to maintain current data. New technologies are presenting themselves that will make more frequent mapping a possibility. They include airborne Light Detection and Ranging Laser (LIDAR), Broad Beam LIDAR and Interferometric Synthetic Aperture RADAR (IFSAR). A great deal of interest has been expressed by emerging and established companies in this section of the Implementation Team Plan. Many of these companies and technologies hold the promise to dramatically reduce the cost for production of these data, however, the Implementation Team must ensure that product specifications can be achieved.

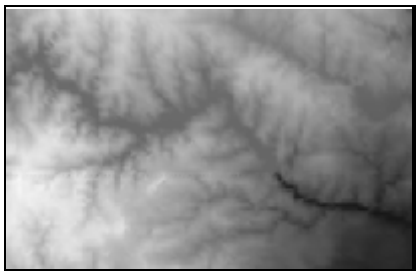


Figure 10.1 - "Bare Earth" digital elevation model (DEM) that shows the relative height of the land surface by interpreting each shade of grey as a different elevation value.

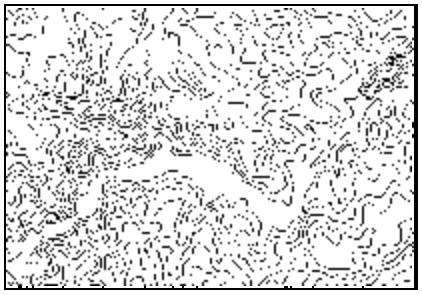


Figure 10.2 - Elevation contour lines that are computer generated from a portion of the DEM in Figure 10.1.

10.2 Existing Statewide Product: The existing elevation data are available from the Department of Natural Resources. They represent 90-meter post spacing with interpolated points at 30-meters that were collected to create 1:12,000 orthophotography (see next section). These data were collected as ASCII files representing x, y & z coordinates in the State Plane Coordinate System NAD 1983, meters. The data are generally considered to be map accurate to a contour interval of 10' +/- ½ contour. These files can be used directly by software packages in use at DNR, but have proven to be problematic for users of the prevalent desktop mapping/GIS software packages. No effort has been made to convert them to a standard DEM product. The entire State is available. The total investment to date is $430,000.00 for coverage of the entire State.

10.3 New Product Specification: Topographic vector contours will be created using appropriate technologies at an interval of approximately .6 meters. In addition to the topographic contours, the digital elevation data shall be delivered as a 3-D model (first surface return) and as a "Bare Earth" model (actual ground elevation). The Federal Emergency Management Agency has developed detailed LIDAR topographic mapping specifications developed by a panel of experts. FEMA's specifications are generally referred to as Appendix 4B. Maryland will adopt the Appendix 4B specifications and modify them as required to ensure that the product specifications can be realistically achieved by potential contractors. The modifications will involve the vertical root-mean-square error (RMSE) accuracy standard to ensure that realistic goals are established for the contractor in varying land cover areas. Initial suggestions will be a 20 cm RMSE for Coastal Plain

areas, 25 cm RMSE for Piedmont areas and a 50 cm RMSE for mountainous areas. All elevations will be orthometric heights. Variably spaced, bare earth digital topographic data in ASCII point file format will be combined with imagery (either flown concurrently or by using existing digital orhtophotos) to eventually establish a Triangulated Irregular Network (TIN) that includes selected breaklines to be used for hydraulic modeling. Uniformly spaced Digital Elevation Models (DEM's), with 5m x 5m point spacing, will be generated in multiple file formats for hydrologic and hydraulic modeling and other federal, state and county applications.

These data will be stored in tiles of approximately 9,000 meters squared on increments starting at the Maryland State Plane Coordinate System NAD 1983. The vertical datum will be NAVD 1988. Data will be produced in each tile area to provide for ortho correction of the 1:2,400 map sheets located in that tile.

10.4 Responsibility for Statewide Production or Acquisition: A Regional Action Team will be established by MSGIC.

10.5 Cost and Procurement Options: The principal option for acquiring elevation products to meet these specifications is contract procurement from the private sector. Current estimates for production of LIDAR data to meet the above specifications range from $450 to $640 per square mile. Therefore, using the number of 1:2,400 scale map sheets required for statewide coverage at an approximate cost of $500.00 per square mile, the total cost will be $5,500,000.

A secondary option will involve working with the Regional Earth Science Application Center at the University of Maryland to develop a commercial instrument based on the Vegetation Canopy LIDAR (VCL) satellite prototype instrument known as LVIS. The cost of obtaining data for statewide coverage is estimated at $950,000 based on the costs to build a new 5-meter instrument, obtain coverage and post-process the data.

10.6 Funding Options: Federal grant funds, federal cost share and state funds (general or special) may be used to procure this data. Maryland may be able to form joint funding arrangements with federal agencies, utility companies, county governments, or other entities in the State. The Regional Action Team will be responsible for developing partnership opportunities and applying for grant funds.

11.0 ORTHOPHOTOGRAPHY DATA PROFILE

11.1 General Disscussion: Digital orthophotography is generally considered the foundation of modern GIS systems. It provides an intuitive map base that eliminates the need for detailed mapping of many individual features. The Department of Natural Resources has managed production of the digital orthophoto quarter quad program for the State since 1991. The State Highway Administration has contracted for additional orthophotography to meet their unique requirements for "right-of-way" projects and other design work. At least thirteen counties have contracted for larger scale digital rectified or orthophoto products. Developing a uniform grid system across the State would help ensure that the respective GIS programs of state and county agencies would integrate better.

11.2 Existing Statewide Product: DNR produced statewide, 1:12,000 scale, color infrared orthophoto coverage from 1991 through 2000. The data are based on aerial photography dated from 1988 through 1995. The products are distributed by DNR as composite color images in 8-bit TIFF format with an accompanying .TFW file. The TIFF files have a rotation factor which is accounted for in the .TFW files. The most prevalent desktop mapping/GIS system encounters problems with this rotational factor, even though the file specification is their own format. The files are distributed in Maryland State Plane Coordinate System, NAD 1983 in meters. DNR finished an innovative partnership with the USGS in March 2001 to populate the National Orthophoto Database with standard federal specification 1:12,000 scale products. The Maryland products were delivered in color formats for approximately two-thirds of the state. The remaining files in the National Database will be black and white format produced for the surrounding states. The cost of production for this product, excluding the photography and DEM expenses, was approximately $ 1,011,000.00.

Figure 11.1 Sample Orthophoto provided by VARGIS, LLC

11.3 New Product Specification: Natural Color Orthophotography shall be created from winter or early spring leaf-off condition imagery or aerial photography. The orthophotos shall be cast on U.S. State Plane Coordinate System (Zone 1900 - Maryland) NAD 1983 in Units of Meters. All orthophoto shall be cast orthogonal to the State Plane Grid to prevent image rotation. The pixel ground resolution shall be one foot. If aerial photography is utilized, the flight altitude shall be 9,000' with a six-inch focal length lense camera to yield source photography at 1:1,800 scale. The grid system shall be based on a map sheet of 600 meters in the Northing direction and 900 meters in the Easting direction. It shall originate at Maryland State Plane coordinates 0,0. Each resulting map sheet shall have a 40 meter over-edge to allow for conversion and mosaicing in other projections. All map sheets shall be radiometrically corrected and balanced for tone against adjoining map sheets to provide a uniform appearance over large areas. Each map sheet shall be stored as an 8-bit composite color image at approximately 7.4 megabytes when uncompressed,

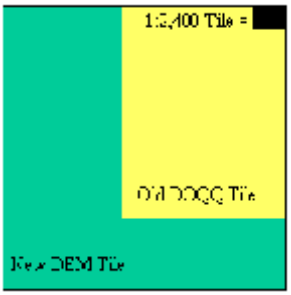


Figure 11.2 - Shows the relative size of the newly proposed DEM Tile (Green/Gray), the existing DOQQ tile (Yellow/White) and the newly proposed 1:2,400 map sheet tile (Black).

or approximately 400 kilobytes when compressed. Each map sheet shall also be stored as a 24-bit, 3-band image which will be 22 megabytes when uncompressed and less than 1 megabyte when compressed to facilitate transfer across Internet.

The 1:2,400 scale map sheets shall be mosaiced and resampled to produce USGS standard specification 3.75' digital orthophotos in the UTM NAD 1983 Projection if there is sufficient interest in this product.

11.4 Responsibility for Statewide Production or Acquisition: A Regional Action Team will be established by MSGIC.

11.5 Cost and Procurement Options: Four options currently exist for acquiring orthophoto products to meet these specifications. 1) They can be licensed from the private sector. 2) Their production can be contracted through standard State procurement methods utilizing a services procurement contracting mechanism. 3) The State or local government agencies might be able to do a Joint Funding Agreement or Innovative Partnership with the USGS. 4) The State might be able to form a partnership with other federal agencies, utility companies, county governments, or other entities in which the State simply funds a portion of the product cost if the contracting agency ensures the State that it will meet standard product specifications.

It is doubtful that we will be able to determine accurate prices for these products due to the exceptionally competitive nature of this market and the number of vendors that might bid on the contract. Using current licensing costs, approximately 2,300 square miles of the "metropolitan" portion of the State could be procured by one agency for the full retail cost of $223.00 per square mile or $512,900.00. Significant price reductions are offered for licensing large areas, but multipliers will be added for sharing the data with county governments and other partners, or for providing Internet viewing access.

Recently, one Pennsylvania County contracted for production and ownership of data at a rate of $30.00 per square mile. However, this is an exceptional case, and the average low cost appears to be approximately $75.00 per square mile if the customer has a suitable DEM. Therefore, it would be reasonable to expect that the State could contract for production at no more than $100.00 per square mile for planning purposes. Based on 51,100 map sheets at .21522 square miles each, the expected Statewide cost would be approximately $1,099,744.00.

11.6 Funding Options: Federal grant funds, federal cost share and state funds (general or special) may be used to procure this data. Maryland may be able to form joint funding arrangements with federal agencies, utility companies, county governments, or other entities in the State. The Regional Action Team will be responsible for developing partnership opportunities and applying for grant funds. DEM is required prior to production of the orthophoto product to obtain the projected costs.

12.0 - POLITICAL BOUNDARIES DATA PROFILE

12.1 General Discussion: The U.S. Geological Survey and the State Highway Administration maintain separate political boundary files at 1:24,000 scale. The SHA file is currently used by agencies within State Government, many counties and a few federal agencies. There is no consistent political boundary file available at a larger scale. Developing a consistent 1:2,400 scale political boundary file for the State will be a significant undertaking, because there is no consistent source material that it can be digitized from. It is likely that each boundary would have to be COGO'ed from historic documents or generated from field surveys. The Implementation Team members recommend that we create a Regional Action Team to evaluate the cost to have all State, county and municipal boundaries surveyed and generated using COGO techniques. This will involve significant field work and political action to reconcile any differences. The border between Maryland and adjoining Virginia and West Virginia will be a significant (but welcome) undertaking.

12.2 Existing Product: As noted above, all State agencies use the political boundary files produced by the State Highway Administration as part of their GRID map product. The original files are created in a CADD system and converted for use in GIS formats. They are available for the entire State in the Maryland State Plane Coordinate System, NAD 1983 in meters. It is not possible to estimate the cost of this individual layer.

12.3 New Product Specification : A Regional Action Team will be established by MSGIC to develop a consistent method and contract specifications for surveys and digital conversion.

12.4 Responsibility for Statewide Production or Acquisition: The Geographic Data Partnership Office should be responsible for creating this layer.

12.5 Cost and Procurement Options: Unknown at this time.

12.6 Funding Options: Unknown at this time.

13.0 HYDROGRAPHY DATA PROFILE

13.1 General Discussion: Hydrographic features (stream and shoreline boundaries with flow and other characteristics) are important data that are used in nearly every mapping and analysis effort.

13.2 Existing Product: Three statewide stream and shoreline files exist for the State of Maryland. One was produced and is maintained by the State Highway Administration as part of its GRID map effort. SHA readily acknowledges that this CADD layer was not produced to exacting standards and is intended to be a cartographic product that provides for the general locations of streams. The Department of Planning and Department of Natural Resources contracted for a digital GIS version of this file which is the "official" State stream file. A second effort was contracted by the Department of Planning well before the completion of the SHA GRID files. The streams were digitized from the U.S. Geological Survey 7.5' quadrangle maps in a low-cost effort to develop data for modeling efforts. Again, the standards were not very exacting. The most current file available was completed in 2000 by the U.S. Geological Survey. It is the 1:24,000 DLG file and is complete for all Chesapeake Bay drainage. This means that portions of Garrett and Worcester counties are not included. This file represents stream locations faithfully from the existing 7.5' U.S. Geological Survey quadrangle maps, but still does not provide the level of detail that is required for state and local mapping programs, nor does it represent up-to-date information.

13.3 New Product Specification : Unknown at this time, but federal specifications for the National Hydrographic Database will likely be used to create a 1:2,400 scale product. The Department of Natural Resources has conducted test mapping to determine the location of streams and ditches on its 1:12,000, 3.75' digital orthophoto quadrangles that were beyond (or in addition to) the "blueline" streams on the U.S. Geological Survey's 7.5' quadrangle maps. Worst case examples lead to 180 additional miles of streams and ditches in a 15 square mile area (one DOQQ map in an area with significant agricultural drainage). In all cases, significant additional stream miles were mapped. It is not likely that mapping streams, ditches and shorelines at 1:2,400 scale will lead to similar significant increases in mileage, but it will lead to much greater positional accuracies that are essential for many programs such as the Conservation Resource Enhancement Program (CREP - vegetative plantings along riparian corridors).

13.4 Responsibility for Statewide Production or Acquisition: A Regional Action Team will be assigned by MSGIC to develop contract specifications and determine the appropriate to manage data production.

13.5 Cost and Procurement Options: Unknown at this time.

13.6 Approximate Cost for Product: Based on very rough estimates developed by the Department of Natural Resources, the line work will cost approximately $1,500,000.00. To attribute this file to the extent of the National Hydrographic Database would likely take an additional $2,000,000.00, resulting in a total project cost of $3,500,000.00.

13.7 Funding Options: Federal grant funds, federal cost share and state funds (general or

special) may be used to procure this data. Maryland may be able to form joint funding arrangements with federal agencies, utility companies, county governments, or other entities in the State. The Geographic Data Partnership Office will be responsible for developing partnership opportunities.

14.0 TRANSPORTATION DATA PROFILE

14.1 General Discussion: Transportation significantly influences the lives of every citizen in the State of Maryland. Highways affect the mobility of the public, impact the environment, effect economic development, and collectively influence the quality of our lives and communities. In 1998 The Maryland Department of Transportation State Highway Administration (SHA) embarked on a new way of doing business called "Thinking Beyond the Pavement" (TBTP). This approach assures projects are developed with a renewed and greater commitment toward community integration and environmental sensitivity. A primary component of this program is understanding the landscape, community, and valued resources before engineering design is begun. Geographic information, especially that which is transportation related, is vitally important for this analysis and maps and other visual tools provide extremely useful project information to the community. TBTP dovetails well with the State's Smart Growth initiatives to promote the needs of the stakeholders and customers. This new era of transportation means putting more emphasis on the people, neighborhoods, and businesses transportation serves, as well as on the sensitive areas of the state that we must protect. For example, Maryland Executives want to map sidewalks on a regular interval as part of the Smart Growth program relating to livable communities. Transportation projects are now evaluated within these larger contexts and require a new and more comprehensive set of transportation data products for decision makers.

Transportation data is currently developed and maintained separately, at different spatial accuracies, by Federal, State and local governments to support their existing business requirements for information, reporting, and management of the system. In order to make most efficient use of available resources for collection of information related to this theme, and to leverage partnerships and data sharing opportunities, the common denominator for transportation data must be established. Priorities for transportation must be set and how needed data can best be collected and shared at all levels of government must be decided. Obviously, such a database includes roads, rail, airports, and ocean ports. A fully comprehensive transportation information system might also includes such features as dirt roads, alleys, sidewalks, multi-use trails, and roads under construction.

Maintenance of the Transportation layer is a good candidate for vertical data integration. In a vertical integration scenario, new features are added at the local level to a high level of spatial accuracy, then migrated through State and Federal government levels, generalizing as needed. Due to its dynamic nature, the transportation layer requires daily maintenance and a data architecture needs to be designed in a manner which encourages and enhances the effectiveness of this data stream while helping to fulfill the requirements of TBTP and Smart Growth. There are also requirements for the ability to query and display information about incidents in a real time environment from both the State (CHART) and from local governments (E-911) which demand accurate and timely data. From the standpoint of information flow, vertical integration of this data layer is already in place. Local governments annually provide information to the Maryland State Highway Administration on new roads within their jurisdictions. Similarly, the State provides information to the Federal Highway Administration through both electronic and paper transactions. For true vertical integration this process needs only to be standardized and applied uniformly.

14.2 Existing Product: The Maryland State Highway Administration maintains 1:24,000 scale transportation data as part of its GRID map series. The files are produced and maintained in CADD formats and converted, by others, to GIS formats as required. Data collected for

Maryland's report on the Vertical Integration of Spatial Data shows that the State Highway Administration spent approximately $110.00 per square mile to create the road centerline file. This equals approximately $1,067,000 for the entire state. Again looking at the Vertical Integration of Spatial Data Report, they spend an additional $194,000 maintaining the file each year.

14.3 Product Specification: Digital vector graphic features representing transportation elements shall be captured from aerial photography. Photography used will be suitable for capture of road centerlines, medians, edge of pavement, edge of travelway, rail lines, airport facilities and other transportation features as needed. Data spatial accuracy shall meet the parameters of National map Accuracy Standards (NMAS) for 1" = 200' (1:2,400) scale mapping. Features shall meet the following graphic standards:

1. Road centerlines, lane centerlines, medians and edges shall be captured as linear graphic elements.
2. Railroads shall be captured as patterned linear elements. A single patterned line shall represent each track.
3. Linear features shall be represented as lines or line strings only. Line elements, elements with only two vertices, shall only be accepted to represent features with no shape points from the beginning to the end of the features. Features requiring shaping points must be represented as line string elements. Line string elements must only contain those vertices needed to maintain feature shape. Features with excessive vertices or non-shaping vertices shall not be accepted.
4. All data will be free of overshoots, undershoots, slivers, duplicate lines or other data anomalies. Where graphic elements meet visually, they shall also meet digitally by exact coordinates.
5. High quality cartographic appearance shall be achieved. Transitions from straight lines to curvilinear line segments shall be smooth and without angular inflections at the point of intersection. There shall be no jags, hooks or zero length lines or line segments. Curvilinear graphic features shall be smooth, with a minimum number of vertices. Line or line segments that are straight, or should be straight, shall be digitized using only two vertices representing the beginning and ending points of the line or line segment.
6. The data shall contain 100% of the features visible on the aerial photography.

14.4 Responsibility for Statewide Production or Acquisition: A Regional Action Team will be assigned by MSGIC.

14.5 Cost and Procurement Options: The transportation layer will have to be created and maintained as a partnership between local and State government agencies. It has a significant impact on local emergency services as part of the E911 service. During the Vertical Integration of Spatial Data study, one county indicated that cost approximately $1,000.00 per square mile for production of a 1:2,400 road centerline file with premise addressing. Using this figure and taking the efficiencies that can be realized taking a statewide project approach, we estimate it could cost between 6 and 8 million to complete a similar file for the entire state.

15.0 CADASTRE DATA PROFILE

15.1 General Discussion: Depending on the mapping technique used, a 1:2,400 scale cadastre file may be the most expensive framework data layer to produce. Maryland is fortunate to be one of only two states that maintain responsibility for parcel mapping at the state level. This allows for production of uniform products on a statewide basis such as the existing MdProperty View product. However, in spite of its small size, Maryland will likely incur greater expenses than many other states during creation of a cadastre layer for two reasons. First is the number of parcels, and the other reason is that our parcels are based on the "Meets and Bounds" system instead of the Public Land Survey System. A cadastre layer built on the "Meets and Bounds" system is inherently more difficult and expensive to accurately map.

Two basic options exist for creating a vector layer of parcel ownership. The first is to convert the existing parcel maps to a vector base and then "approximately hand fit" each parcel boundary to the visual references in a 1:2,400 scale orthophoto. This effort will create a vector based product that is more precise and useful than existing products, but can not be used for legal purposes. The second option uses a technique called COGO which is an acronym for Coordinate Geometry. Using this technique, an operator enters the "Meets and Bounds" from the deed description or plat for each property. Eventually a uniform cadastre layer is created by the accumulation of individual property plats. This technique requires a great deal of reconciliation, because many surveys are not accurate and the boundaries of adjoining parcels will not join or "close" properly. Assuming it is accurately created (under the supervision of a Licensed Land Surveyor), this layer can then be used for certain legal purposes.

There is also significant interest in the maintenance of information regarding lands managed under public ownership, currently about 15% of Maryland's land mass. Under the new 2000 Chesapeake Bay Agreement (C2K) each state will have to report public land ownership and show progress toward goals established by the Agreement to increase the acreage of public lands. Additionally, Maryland has many easement acquisition programs including the Maryland Agricultural Land Preservation Foundation easement program, the Maryland Environmental Trust easement program and the Maryland Historic Trust easement program. Each of these programs can benefit from more precise and larger scale cadastre data.

15.2 Existing Product: Several counties have initiated or completed vector based mapping of their parcels. An accurate and up-to-date inventory does not exist. The Maryland Department of Planning (MDP) produces MdProperty View which is a product that combines, 1) binary raster scans of the existing parcel maps, 2) a vector node for each parcel that is linked to 3) the Department of Assessment and Taxation's real property database and 4) other non-parcel specific layers that make the product more useful to a wider range of users. This digital map series is available for the entire state at a scale of 1:24,000. During the Vertical Integration of Spatial Data study, MDP determined that this product cost approximately $818,000.00 to create. Since its introduction, it costs approximately $1,228,000.00 to maintain the product on an annual basis. The existing product is created through a "zero-base budget" and depends on data sales to fund the operation.

15.3 Product Specification : Unknown at this time.

15.4 Responsibility for Statewide Production or Acquisition: A Regional Action Team will be assigned by MSGIC.

15.5 Cost and Procurement Options: MSGIC studied data production costs in 1999 as part of its Vertical Integration of Spatial Data study. It was determined that the existing parcel maps could be vectorized and "hand fitted" to an orthoimage base map for approximately $1.40 per parcel. It was also determined that using COGO techniques, it costs approximately $24.00 per parcel. This results in a range of costs between approximately $2,900,000.00 and $49,100,000.00. In addition to the initial conversion cost, there will be a significant maintenance costs associated with this layer due to the continuous sale of real property in the State.

15.6 Funding Options: Funding options will have to be studied by the Regional Action Team.

16.0 GEODETIC CONTROL DATA PROFILE

16.1 General Discussion: This is one of the easier layers to create and maintain. The data itself is stored by the National Geodetic Survey (NGS) and submitted to agencies on a yearly basis. The processing of the data is all that would be required.

16.2 Existing Product: A point coverage file is created from the ASCII format NGS DAT files. Each point contains all of the data that is included in the NGS data sheets. The DAT files are created at NGS for all geodetic control monuments that have been logged and blue booked with the agency. The accuracy of this data will vary from point to point but all will be more than acceptable for any 1:2,400 scale mapping effort. The accuracy is generally +/- 6 seconds.

16.3 New Product Specification : Same as above.

16.4 Responsibility for Statewide Production or Acquisition: As The Plats and Surveys Division of the Maryland State Highway Administration has done in the past, they will continue acquiring this data from NGS and producing the ESRI shape file layer. This office will also maintain this data layer and update it on a yearly basis at the same time that NGS releases their yearly updates to the DAT files.

16.5 Cost and Procurement Options: The simplest option for this data layer is to continue the process that is currently in place, which is to continue the data creation within the Plats and Surveys Division of the Maryland State Highway Administration. The data is available free of charge from the Maryland State Highway Administration. The cost of processing the data should be able to be completed within SHA, but depending on volume of work, consultant assistance may be required.

16.6 Funding Options: No additional funding appears to be required at this time.

17.0 - GEOLOGY DATA PROFILE

17.1 General Discussion : The Maryland Geological Survey (MGS), part of the Department of Natural Resources (DNR), has been the primary Maryland state government agency for the production of geologic maps. The Environmental Geology and Mineral Resources Program, of the MGS, produces standard geologic maps that are used by agencies and organizations such as the State Highway Administration (SHA), the United States Geological Survey (USGS), United States Department of Agriculture (USDA), Maryland Department of the Environment (MDE), county governments, as well as private contractors and the public.

Geologic mapping by the Environmental Geology and Mineral Resources Program has primarily been completed at two scales, 1:24,000 (for 7.5-minute quadrangle maps) and 1:62,500 (for individual county maps), with some site-specific geologic maps completed at other scales for special projects. Since 2000, the Environmental Geology and Mineral Resources Program has shifted from traditional cartographic methods to digital methods using GIS software for geologic map production. Currently, unpublished maps as well as new mapping projects are being developed digitally for publication.

It should be noted that, in addition to standard geologic maps, the entire MGS produces a variety of maps containing information such as, but not limited to, shoreline changes, geologic resources, hydrogeologic recharge, physiographic provinces and sediment distribution.

17.2 Existing Product: Standard geologic maps exist statewide at the county scale (1:62,500) in hard copy (paper). Less than half the state is mapped at a scale of 1:24,000 (the standard for a 7.5-minute quadrangle). However, a number of the existing maps are over 25 years old and are in need of review, update, revision, and digitization.

17.3 New Product Specification: To produce additional maps at 1:24,000 scale, spatial geologic data would need to be collected in the field, which would be supplemented by GPS collected data for point features. These data would then be compiled and transformed into digital vector data. The digital vector data would consist of line and point features for structural elements, polygons for geologic rock units and surficial deposits, and point features for any geohazards that are found. All data would meet the criteria set by the National Map Accuracy Standards for 1:24,000 scale mapping set by the United States Geological Survey.

17.4 Responsibility for Statewide Production or Acquisition: The MGS will work in conjunction with the Regional Action Team established through MSGIC.

17.5 Cost and Procurement Options: One quadrangle mapped and digitized per year would cost approximately $110,000. This estimate **does not** include overhead costs including, but not limited to: additional support staff, software, hardware, state vehicles, vehicle maintenance, and travel expenses.

17.6 Funding Options: No funding options are being developed at this time.

18.0 WATER AND SEWERAGE PLANS DATA PROFILE

18.1 General Discussion: The Code of Maryland Regulations (COMAR), Title 26 Department of the Environment provide specifications for the creation, review and adoption of county water and sewerage plans as required by Environment Article, §9-511 – 9-51, Annotated Code of Maryland. The plans must be submitted to the Departments of Planning, Natural Resources and Environment for review and comment. Counties are required to develop and submit annual amendments or revisions to the plans.

18.2 Existing Product: Individual counties maintain their own water and sewerage plans. The scale and detail are specified by COMAR but still vary from county to county. The Department of Planning creates and maintains a sewer service mosaic derived from the county plan submissions in digital format. The database was developed by obtaining digital data from individual counties or digitizing hardcopy maps. The compilation scale of the plans vary but the derived scale is published as 1 inch = 1 mile.

18.3 Product Specification: COMAR 26.03.01.04 details the requirements for the submission of the County plans to the Maryland Department of the Environment. In general, the regulations require counties to submit to specific map products for each utility; a small-scale 1 inch = 1 mile displaying general details and a larger-scale map series, 1 inch = 2,000 feet displaying utility and related features in greater detail.

The large-scale maps must include existing or proposed facilities including wells, reservoirs, intakes, transmission and feeder mains, storage facilities, interceptor and truck sewers, pumping stations, force mains, treatment works, outfall sewers, and service areas. Facility sizes or capacities are to be delineated as appropriate. Existing and planned service must be identified as follows: (S = Sewer and W = Water) 1 – Existing or under construction, 2 – final planning stages, 3 – immediate priority, 4 – construction programmed for 3 to 5/6 years, 5 – construction programmed for 6/7 to 10 years, 6 – no planned service. COMAR specifies standard symbols for the features in the database.

18.4 Responsibility for Statewide Production or Acquisition: Responsibility for statewide production should reside with the individual counties with technical and financial assistance being provided to counties requiring such assistance. The Department of the Environment should create the mosaic based on the plan submissions. A Regional Actions Team will be assigned to develop specifications, data dictionary and ensure compliance with COMAR.

18.5 Cost and Procurement Options: The water and sewer plans will need to be developed as a cooperative initiative between state and county governments. Where available, counties are using GIS and CADD technologies to create the plans. Assistance will be required to ensure adherence to COMAR standards. Since water and sewer plans generally follow cadastral (parcel) boundaries, this layer is "derivative" database. Large-scale compilation of the plans should commence after a suitable cadastral layer is developed. The cost to develop a consistent small-scale (1 inch = 1 mile) database should be less than $10,000 per county. The cost to develop a large-scale (1 inch = 2,400 feet) would cost on average $50,000 per county.

18.6 Funding Options: Cost for development of county plans would remain the responsibility

of the individual counties. Funding options will have to be studied by the Regional Action Team.

19.0 HISTORIC PROPERTIES DATA PROFILE

19.1 General Discussion: This information consists of properties that have either been determined historically significant or potentially historically significant. The Maryland Historical Trust began maintaining a statewide inventory of historic sites in the early 1970's. Traditionally, the data has been collected and maintained at a 1:24000 scale. Each property has a unique ID number, name, an inventory form containing textual description, and photographs. The inventory includes individual buildings, sites, districts, structures and objects. The statewide inventory does not include a comprehensive survey of burial sites and cemeteries.

19.2 Existing Product: At the state level the Maryland Historical Trust, located within the Maryland Department of Housing and Community Development, has developed three separate vector layers to depict historic properties. One layer depicts approximately 24,000 individual buildings, districts, structures, sites and objects that have been identified as significant or potentially significant historic sites listed on the state-level Maryland Inventory of Historic Properties. A second layer depicts approximately 1200 properties that are listed on the federal-level National Register of Historic Places. A third layer depicts Maryland Historical Trust Preservation Easements, properties with historic preservation easements. All of these have been developed at the 1:24000 scale. Coverage is complete with the exception of Baltimore City. All of the properties in these layers are currently digitized as polygons.

Some counties, particularly in the metropolitan areas, also have developed historic sites data at a scale of 1:2400. These systems should serve as the starting point for developing the specifications for the larger scale information.

19.3 New Product Specification: Specifications will need to be developed cooperatively between the state and county and local entities. County interests may involve tying the historic sites designation to the cadastral maps or data. Specifications would possibly entail rectifying existing vectors to the 1:2400 scale; however, issues of data normalization (e.g., one historic property covering multiple parcels; multiple sites designated within a single parcel) and topological problems (e.g. overlapping district boundaries) would need to be addressed. Specifications will need to include a process for generalizing the data back to a 1:24000 scale for state-level management purposes, federal reporting, and intrastate projects.

19.4 Responsibility for Statewide Production or Acquisition: The Maryland Historical Trust has a legislated mandate to maintain a statewide historic sites inventory and is the agency designated by the U.S. Dept. of Interior to manage the National Register listings for Maryland. Data collection for the statewide inventory, however, is often coordinated through the county Planning and Zoning offices, with many surveys funded through Maryland Historical Trust grants. Some counties have incorporated historic sites information into a county GIS.

19.5 Cost and Procurement Options: This data will need to be upgraded through a cooperative effort between the state and the counties/Baltimore City. The data can only be developed in areas in which the other base layers (cadastral and orthoimagery) are complete. Cost per jurisdiction would vary widely, from minimal in counties where this data is already developed (e.g. Howard), up to as much as $50,000 for completing Baltimore City. A preliminary cost estimate for statewide development is $450,000.

19.6 Funding Options: No funds have been identified to develop this information; however, possible sources include National Park Service, State Highway Administration Tea-21 funds; and MHT grant funds to local jurisdictions.

Maintenance: Approximately 700 additional properties are added annually to the inventory through field surveys. In addition, data is corrected through field reports, and condition is noted (e.g., demolished). Occasionally, houses are relocated (moved) as well. MHT currently has one full-time staff position for maintenance of GIS data.

20.0 ARCHEOLOGICAL SITES DATA PROFILE

20.1 General Discussion: This information consists of archeological sites that have been inventoried by the Maryland Historical Trust, a state agency located in the Maryland Department of Housing and Community Development. Begun in the late 1960s, the inventory contains approximately 10,000 sites. Traditionally, the data has been collected and maintained at a 1:24000 scale on USGS topographic quadrangle maps. Each property has a unique ID number, name, and a form containing information about the site, sometimes including reports and photographs.

20.2 Existing Product: Locations of archeological sites are confidential and are protected from release under state law in order to prevent site looting. Therefore the Trust has prepared both an internal and external version of the sites data. The internal layer depicts the approximate boundaries of sites as recorded in the field on USGS topographic maps. The second product, prepared for outside distribution, is archeological site presence grids, which consist of 700-meter-wide grid cells superimposed on each county. Cells which cover areas where archeological sites have been recorded in the Maryland state inventory are classified as "present". The archeological site grid is intended to be used as a general planning tool to identify areas in which recorded archeological sites are found without revealing more precise site information.

20.3 New Product Specification: Due to the nature of the original mapping on UGSG quads, and lack of more specific information, rectification onto a larger scale would be virtually impossible. Even re-survey of existing sites, if feasible, would not be successful in many cases without test excavations in order to determine site boundaries. However, once a new, larger scale topographic map becomes widely available, it could be used for future site recording. In any case, it would be desirable to re-do the separate county grids that currently exist into one statewide grid to provide seamless coverage across county boundaries.

20.4 Responsibility for Statewide Production or Acquisition: The Maryland Historical Trust has a legislated mandate to maintain a statewide archeological sites inventory. Data collection for the statewide inventory is centralized through that office. Many counties have copies of the presence/absence grid of archeological sites.

20.5 Cost and Procurement Options: At this time, no changes in the current data are planned. Creating a new, statewide grid system could be done as part of the normal update cycle.

20.6 Funding Options: N/A

20.7 Maintenance: Approximately 250 additional sites are added annually to the inventory through field surveys. MHT currently has one full-time staff position for maintenance of GIS data.

21.0 ZONING DATA PROFILE

21.1 General Discussion: Maryland Code does not specify the requirement for counties and municipalities to create and maintain zoning databases. The code does; however, provide the authority for counties and municipalities to regulate zoning designations. County and municipalities in Maryland have existing regulations that govern the zoning designation of real property. Most zoning designations conform to property boundaries but there are exceptions that create "split" zoned parcels. Comprehensive rezoning activities occur on a designed schedule. There is usually a process to provide for "out-of-cycle" designation changes. Traditionally, the authoritative zoning maps are those signed by their respective governing authority. Digital representation of the zoning maps may exist but they are not authoritative.

21.2 Existing Product: Individual counties maintain their own zoning maps. The scale and detail is depend on the scale of the base map used in producing the zoning maps. Zoning maps are typically based on one of two base maps: cadastral maps or planimetric maps. The Maryland Department of Planning creates and maintains a mosaic derived from the county maps in digital format. The database was developed by obtaining digital data from individual counties or digitizing hardcopy maps. The compilation scale of the zoning maps vary but the derived scale is published as 1 inch = 1 mile.

21.3 Product Specification: Specifications for zoning databases vary from county to county. Common production scales are 1"=200' and 1"=600'. Counties could continue to produce zoning databases at a variety of scales but the mosaic would need to be "published" at the smallest compilation scale. It is unlikely that zoning designations will be consistent statewide. Generalization through zoning designation could be developed to present the data in consistent categories, e.g. residential, commercial, industrial, etc.

21.4 Responsibility for Statewide Production or Acquisition: Responsibility for statewide production should reside with the individual counties with technical and financial assistance being provided to counties requiring such assistance. The Department of Planning should create the mosaic based on digital submissions or by digitizing hardcopy maps. A Regional Action Team will be assigned to develop specifications and a data dictionary.

21.5 Cost and Procurement Options: The zoning maps will need to be developed as a cooperative initiative between state and county governments. Where available, counties are using GIS and CADD technologies to create the plans. Priority funding should be provided to counties and municipalities not currently using GIS or CADD to create their maps. Since zoning designations generally follow cadastral (parcel) boundaries, this layer is "derivative" database. Large-scale compilation of the plans should commence after a suitable cadastral layer is developed. The cost to develop a consistent small-scale (1 inch = 1 mile) database should be less than $10,000 per county. The cost to develop a large-scale (1 inch = 2,400 feet) would cost on average $50,000 per county.

21.6 Funding Options: Cost for development of county zoning maps will remain the responsibility of the individual counties. Funding options will be studied by the Regional Action Team.

22.0 WETLANDS DATA PROFILE

22.1 General Discussion: Very few features have been the subject of as many mapping exercises as wetlands. Federal, State and local agencies have many uses for wetlands data to support a variety of regulatory, enhancement and stewardship programs. The Maryland Department of the Environment (MDE) has assumed portions of the Federal 404 and Section 10 permit programs and has its own programs to regulate construction or fill activities in tidal and nontidal wetlands. County governments participate in these programs to ensure consistency in permit issuance. Regulators and the regulated public are constantly seeking wetlands maps of larger scale and greater precision, although regulatory personnel do not generally want a series of regulatory maps unless they can match the precision of a field delineation and survey. Field delineations are conducted for every permit issued in nontidal wetlands. The Maryland Department of Natural Resources (DNR) has studied the "attitudes" of regulatory personnel with regard to regulatory maps and produced some grey literature on the subject.

DNR has participated in several Federal research programs to find better methods to accurately inventory nontidal wetlands and, again, has produced some grey literature on the subject. To date, no method has proven more reliable than photo interpretation for the original inventory, although using the sum of several programs will yield the most comprehensive view of wetlands. New methods using satellite imagery to conduct status and trends mapping are showing great promise. One of the greatest problems in mapping wetlands is gaining concurrence on the definitions of what will be mapped.

22.2 Existing Product: Since the early 1980's, the National Wetlands Inventory (NWI) of the U.S. Fish and Wildlife Service has worked to produce a 1:24,000 scale wetlands inventory of the nation and has conducted many status and trends reports for Congress. The National Resources Conservation Service (NRCS) maintains the status and trends of wetlands (and other features) based on the National Resources Inventory which is a sampling method. Recently, these two groups agreed to common definitions of wetlands to ensure their efforts produced consistent results. The NWI data are commonly used for planning purposes in Maryland since they represent the only complete statewide inventory. The NRCS also maintains the "Swamp Busters" data on wetlands location to support incentive programs that prevent farming on wetlands. The National Oceanic and Atmospheric Administration (NOAA) produced the Coast Watch land cover inventory in 1988 that identified tidal and nontidal wetlands using Landsat satellite imagery.

Since 1971 Maryland has maintained a series of 1:2,400 scale tidal wetlands "maps" that show the location of State and Private tidal wetlands. These maps are legal documents that are filed with the Circuit Court Clerk in each of the 16 tidal counties. The Tidal Wetlands Maps are produced on an uncorrected aerial photographic base that makes it difficult to transfer the data to a modern map accurate base.

In 1988 the Nontidal Wetlands Protection Act was passed. It required the DNR to produce a series of nontidal wetlands maps. DNR contracted with Salisbury State University to produce a series of digital maps using SPOT Satellite Imagery as the base with an overlay of the NWI data for nontidal wetlands. In addition, the State's nontidal Wetlands of Special State Concern (WSSC) were identified and delineated on this map series. That map series was "retired" in 1998 due to the increasing availability of a larger scale map from DNR and the production of a smaller scale

(1:63,360) countywide map series that showed the updated locations of WSSC's and wetlands.

In 1991 DNR began production of the 1:12,000 scale digital orthophoto quarter quadrangle (DOQQ) maps using color infrared imagery to support a statewide 1:12,000 wetlands inventory. The DOQQ maps were completed in 1999 and the wetlands inventory is complete or in production for all counties except Garrett, Allegany and Washington.

22.3 Product Specification: Given the fact that all permit issuance requires a field delineation, it would not be cost effective to produce a statewide 1:2,400 scale wetlands map. Previous experience shows that the cost of mapping wetlands on a per square mile basis increases in an approximately linear fashion with the increase in map scale. Therefore it costs approximately four times as much to maps wetlands at 1:12,000 scale as it does at 1:24,000 scale.

The existing 1:12,000 wetlands inventory should be enhanced and continually maintained to improve its quality. Enhancement should include; 1) "fitting" it to the 1:2,400 scale base maps in areas where there are obvious fit problems, 2) incorporating field delineations and surveys into the database, 3) incorporating wetland mitigation and other naturally created wetland areas, and 4) incorporating wetlands from other data sources that support the identification of additional features. In addition, the State should work with the Regional Earth Science Applications Center at the University of Maryland to develop new methods of inventorying wetlands based on new sensors and the availability of more precise data such as the proposed Digital Elevation Model.

22.4 Responsibility for Statewide Production or Acquisition: The Department of Natural Resources should continue to be the focus for production of wetlands data.

22.5 Cost and Procurement Options: Continual maintenance of the wetlands inventory and coordinating with external research activities will require one permanent FTE.

22.6 Funding Options: DNR should be authorized one additional FTE during the second year, if the Geographic Data Partnership Office is authorized and funded.

23.0 CRITICAL AREA BOUNDARY DATA PROFILE

23.1 General Discussion: The Critical Area law required that a 1000-foot Critical Area buffer be mapped from the landward edge of State Tidal Wetlands. This law affects the 16 counties that have tidal waters and their political subdivisions. In addition to the boundary line, the maps had to appropriately identify Resource Conservation Areas (RCA), Limited Development Areas (LDA), and Intensely Developed Areas (IDA) according to the law that was passed in 1985. Program managers completed mapping of the boundary on the circa 1971 State Tidal Wetland boundary maps by manually swinging a series of 1000' arcs from the tidal wetlands boundary line. Each of the jurisdictions affected by the Critical Area Law were required to identify the RCA, LDA and IDA areas. Most chose to transfer the Critical Area Boundary completed by the Department of Natural Resources (DNR) over to another map base that they commonly used. Each jurisdiction then petitioned the Critical Area Commission to accept their map products which became the basis for regulating these areas. This approach led to a variety of inconsistent map types.

23.2 Existing Product: At their headquarters office, the Critical Area Commission maintains a copy of the official paper maps for each jurisdiction. The Commission digitized the Critical Area features for planning purposes, but the work was not completed for mapping purposes. Beginning in 1999, DNR began adjusting the digital Critical Area Boundary files to an approximate map scale of 1:24,000 and verified that the RCA, LDA and IDA areas were correct. That work should be completed by December 2001. The Commission is also performing quality control checks on the work to certify the maps for use by public agencies.

23.3 New Product Specification: Since the Critical Area Boundary and area designations are used as a regulatory map and affect the use of private property, the I-Team recommends that the 1:24,000 scale data should be adjusted to the proposed 1:2,400 scale orthophoto and cadastral map base. This work should be conducted in consultation with a licensed land surveyor.

23.4 Responsibility for Statewide Production or Acquisition: A Regional Action Team will be assigned to develop a contract specification and mechanism for production of Critical Area data working in consultation with each affected jurisdiction. The local jurisdictions could use these same contracts to work directly with the vendors for quality control and verification purposes. The I-Team recommends that the Department of Natural Resources maintain custodial responsibility for this map series.

23.5 Cost and Procurement Options: Production of 1:2,400 scale Critical Area data should be started after the orthophoto and cadastral bases are completed for each county. Based on previous adjustment work, the cost to produce 1:2,400 scale Critical Area Boundary data should be approximately $400,000.00.

23.6 Funding Options: If the Geographic Data Partnership Office is authorized and funded the money should be apportioned from the Agriculture and Natural Resource related data allocation as determined by the oversight board.

24.0 PROTECTED LANDS DATA PROFILE

24.1 General Discussion: There is an increased emphasis on reducing urban sprawl in Maryland and preserving open spaces to serve as natural corridors and hubs to maintain environmental quality. The mapping of Protected Lands, or lands under some form of protection from the threat of development, have become critical to many Smart Growth programs as well as a requirement of the 2000 Chesapeake Bay Agreement. These data, originally released in 1994, are useful for many purposes and have become very popular for governments, private businesses and numerous advocacy groups.

24.2 Existing Product: The Protected Lands theme is currently managed as six separate databases. There is a separate file for 1) Federal lands (including military bases), 2) properties owned by the Department of Natural Resources (DNR), 3) county parks, 4) lands held by private conservation groups (such as The Nature Conservancy), 5) the Maryland Environmental Trust which holds donated easements, and 6) the Maryland Agricultural Land Preservation Foundation which purchases easements.

Each database contains a vector property boundary and attribute database. The files are digitized from a variety of source materials and are created to be map accurate at 1:63,360 scale. The update frequency ranges from annual cycles to an "as-we-get-to-it" cycle. Since there are many producers of these databases, some databases are merely collected from the producer and added to the collection. Other data custodians do not have the mapping capability so DNR and the Department of Planning create the rest. But is has been primarily DNR that has been the producer and organizer of this mapping effort and they are recognized as the custodian of these data.

24.3 New Product Specification: If the Geographic Data Partnership Office is approved, digital 2400-scale cadastral data for properties (or portions of properties) will be collected or created for each of the appropriate Protected Lands themes. The attribute database will include property ownership information in addition to the data elements required by the respective protection program.

24.4 Responsibility for Statewide Production or Acquisition: Ultimately, it is envisioned that the Maryland Department of Assessments and Taxation, which is the State agency responsible for tracking and managing land ownership information, would add land protection information to the land ownership information that it already collects. Until that time, however, some entity shall be responsible for collecting, managing and distributing the digital protected lands databases. Since there are, and will continue to be, multiple parties involved in the creation of these data, there will be a great deal of coordination, communication and data sharing between the partners. These partners range from federal, state and county governments, land trusts, advocacy groups and other entities that buy or hold land that meets the definition of "protection." The Department of Natural Resources or the Department of Planning should lead this effort.

24.5 Cost and Procurement Options:

24.6 Funding Options: It will require at least two FTE's to keep the Protected Lands databases current on an annual basis. The duties will include coordinating with the various partners, collecting

existing data, creating the data that does not exist, performing quality assurance reviews and package the data for distribution.

25.0 LAND USE AND LAND COVER DATA PROFILE

25.1 General Discussion: Land Use and Land Cover data are separate but related data themes. In Maryland, land cover is generalized into seven landscape categories including developed, agricultural, forest, grasslands, open water, wetlands and bare ground. Typically land use represents man's specific uses within these categories. For example developed lands can include commercial, industrial, institutional and residential uses. These categories can be divided even further into more distinct activities or uses. A commercial property could be used for a dry cleaning store, a gas station, a food store or a book store.

Each land cover or land use has particular impacts that are important to modeling efforts for environmental impacts. These are also important for understanding and planning growth, looking at human health issues and providing public services. Land use and land cover data are one of the most important and popular geographic data types.

25.2 Existing Product: The MDP data is a GIS land use and land cover data product that was originally generated by aerial photographic interpretation with updates from LandSat satellite imagery. In addition, the MDP data has been enhanced by using MdProperty View to more accurately identify developed land use categories. Maryland land use statistics are developed in cooperation with all 23 counties and Baltimore City. The current land use statistics and projection were reviewed and approved by the local jurisdictions in 2000.

The MDP data is representative of both statewide and county trends in development (acres by type). It tracks the conversion of resource land to development based on a statewide inventory. The land use data is a complete inventory based on geo-rectified LandSat satellite imagery and Md Property View.

The land use data base used by the Maryland Dept. of Planning is based on a modified Anderson Level II classification system and contains 20 land use/cover classes. It is a standard classification system used by land planners. Based on the number of households per acre, this classification scheme divides developed land into nine land use/cover categories.

The 1990 Land Use / Land Cover databases were derived from high altitude aerial photography. The photographs were interpreted and land use was outlined in polygon format using a ten-acre minimum map unit. No adjustment was made for the natural distortion caused by the curving of the Earth's surface. While this difference appears minimal in a single photograph, the distortion can become significant when map sheets are tiled together. This is especially true when geo-rectified data, which is data that has been adjusted to compensate for the natural distortion, is "layered" over the land use database.

The 1994 Land Use / Land Cover databases began with the 1990 data as a jump-off point. The 1990 vector files were laid over geo-rectified LandSat satellite imagery. Overlaying the two data sets allowed technicians to pick out where new development and other changes had occurred. This made developments hidden by forest cover, infill areas, and mistakenly identified polygons much clearer and easier to identify. A third step involved superimposing the more finely delineated State Highway Administration's 1:24,000 scale shoreline onto the 1994 Land Use / Land Cover files.

The 1997 Land Use databases are further refinements and updates of the 1994 Land Use

databases. SPOT Satellite Imagery (1994) and MDProperty View (1997 Edition) parcel point data were used to make corrections similar to those performed to create the 1994 databases. In addition, land uses 1991 (agricultural large lot residential development) and 192 (forested large lot residential development) were eliminated. Using the satellite imagery and parcel point information, areas formerly coded as 191 or 192 were re-evaluated and broken into their separate residential, agricultural or forested cover components. In addition, a new code of 80 (transportation) was introduced where applicable. Transportation features include major light rail or metro stations and large "Park 'N Ride" lots, generally over ten acres in size. In addition to this the Maryland Office of Planning has worked with each individual county and Maryland Property View to "ground truth" the results. Hoping to insure the best quality land use/land cover data. The 1997 updates for all Maryland jurisdictions were released in late 1998.

Direct comparisons of land use statistics for 1990 and preceding years with 1997 data were complicated by significant improvements to the 1997 GIS coverage. To resolve this problem, the improvements made to the 1997 data had to be incorporated into the 1990 data (Weller and Edwards, 2001) using Md Property View. The original 1973, 1981, and 1985 land use data were also reconciled with the 1997 land use.

25.3 New Product Specification: The I-Team recommends production of a 1:12,000 scale, Anderson Level II (modified) land cover and land use data theme with an update cycle of every three years. The classification scheme shall be adapted from the scheme currently used by the Maryland Department of Planning except as noted herein. A cross-walk table shall be devised to support the National Land Cover Database.

The minimum mapping unit shall be one acre, or smaller for obvious significant features. The current transportation features from the State Highway Administration shall be incorporated. Linear features greater than 20 feet in width shall be identified.

The Contractor shall intersect the land cover/land use classification file with the Department of Natural Resources existing 1:12,000 scale wetlands inventory and create new polygon boundaries. The newly created boundary file will be attributed with the existing three digit (OP) attribute, followed by a fourth digit using 0 for upland and 6 for wetland.

All work will be edge-matched throughout the project area and all gaps and overshoots will be eliminated. All polygons and linear features will be attributed with a four digit code. Work will be performed to meet national map accuracy standards at the compilation scale of 1:12,000.

25.4 Responsibility for Statewide Production or Acquisition: The Maryland Department of Planning should continue to be responsible for production of land use and land cover data. They have an existing network of planners who work with local government to ensure the data are accurate.

25.5 Cost and Procurement Options: Based on previous work completed by Towson University for the Department of Natural Resources, this work should cost approximately $50.00 per square mile or about $500,000.00 for the land area of the state.

25.6 Funding Options: The I-Team recommends allocation of approximately $170,000.00 per

year to support land use and land cover mapping activities on an on-going basis.

26.0 SMART GROWTH DATA SUITE PROFILE

26.1 General Discussion: Eleven different map products were required to implement the various elements of Governor Parris N. Glendening's Smart Growth Program initiatives. Most of these products were created under "extreme" time schedules to avoid delaying implementation of the program elements.

26.2 Existing Product: The eleven existing map products in this suite are briefly described in this section. They represent a wide range of mapping protocols from many custodians.

26.2.1 HotSpot Community Initiative

Custodian: Department of Public Safety & Correctional Services
Division of Parole and Probation

Description: Thirty-five (35) Maryland communities receive state and federal grant funding through its Cabinet Council on Criminal and Juvenile Justice's HotSpot Communities Initiative, a statewide crime-reduction strategy that promotes locally based, comprehensive planning in high-crime at-risk neighborhoods. It is one of several statewide initiatives in the country that approach crime control and prevention with a focus on concerns and priorities at the community level and promote collaboration across criminal justice system components, community institutions, and state-level agencies. HotSpot Communities are based on strategies implemented by neighborhoods and nonprofit community advocate groups that had been successful in collaborating and involving key community leaders in solving problems in the community.

26.2.2 Home Loan Boundaries

Custodian:

Description:

26.2.3 Priority Funding Areas delineated as of 11/1/1999

Custodian: Maryland Department of Planning

Description: The 1997 Smart Growth Areas Act established certain areas as Priority Funding Areas determining the locations most suitable for State-funded projects. These areas are: municipalities, Baltimore City, areas inside the Baltimore and Washington Beltways, Revitalization Areas designated by the Maryland Department of Housing and Community Development (DHCD), Enterprise Zones, and Heritage Areas. This legislation allows Counties to designate additional areas as Priority Funding Areas if they meet specified requirements for use, water and sewer service, and residential density. Counties must provide maps and other information which show the precise location of their Priority Funding Areas based on criteria in the legislation. The Maryland Department of Planning is responsible for providing State agencies
with maps that illustrate the Priority Funding Areas along with any comments by the Department of Planning on locally designated areas.

Areas eligible for county designation are:

- Areas with industrial zoning;
- Areas with employment as the principal use, which are provide with, or planned for, sewer service;
- Residential areas which have an average density of 2 or more units per acre, are within designated growth areas, and are served by water or sewer systems, or
- Rural Villages designated in the comprehensive plan before July 1, 1998.

Other areas within county-designated growth areas that:

- Reflect a long-term policy for promoting an orderly expansion of growth and an efficient use of land and public services;
- Are planned to be served by water and sewer systems, and
- Have a permitted density of 3.5 or more units per acre for new residential development.

26.2.4 Main Street Maryland Downtown Revitalization Program

Custodian: Department of Housing and Community Development

Description: Main Street Maryland is a comprehensive downtown revitalization program created by the Maryland Department of Housing and Community Development. Its goal is to strengthen the economic potential of Maryland's traditional main streets and neighborhoods. Using a competitive process, Main Street Maryland will select communities that make a commitment to succeed, and will assist them in improving the economy, appearance and image of their traditional downtown business districts.

To accomplish these goals, the Department has partnered with the National Trust for Historic Preservation's National Main Street Center, which developed the Main Street Approach to downtown revitalization. Since 1977, the Main Street Approach has been implemented in over 1400 communities nationwide, resulting in net gains of 33,000 new businesses and 115,000 new jobs. Over seven billion dollars cumulatively reinvested in these communities has resulted in a reinvestment ratio of over $30 for every $1 used to support a local Main Street program. Currently, the communities selected are Cumberland, Easton, Mt. Rainier, Oakland, the Charles Village Community Benefits District in Baltimore City, Denton, and Westminster.

26.2.5 Live Near Your Work Program

Custodian: Department of Housing and Community Development

Description: The Live Near Your Work (LNYW) Program is a partnership between the Maryland Department of Housing and Community Development (DHCD), local governments, and Maryland's businesses and institutions to provide a cash incentive for employees to live near their work in targeted neighborhoods. Participating employees will receive a minimum $3,000 grant for costs associated with the purchase of their home.

26.2.6 Enterprise Zones

Custodian:: Maryland Department of Business & Economic Development
Maryland Department of Planning

Description: Enterprise Zones are designated areas in each Maryland County and Baltimore City for which special tax incentives are available to industrial and commercial businesses that hire additional full-time workers. Each jurisdiction provided either maps or digital files depicting the Enterprise Zones. The Maryland Department of Planning then created digital data using the property map data from MdProperty View.

26.2.7 Empowerment Zones

Custodian: Maryland Department of Planning
Baltimore City Department of Planning

Description: Empowerment zones are areas in Baltimore City which have received special designation by the U.S. Department of Housing and Urban Development.

26.2.8 Smart Growth Designated Neighborhoods

Custodian: Department of Housing & Community Development
Department of State Planning

Description: Designated Neighborhoods are existing mixed-use (residential and commercial) areas in need of social or physical revitalization which have been approved by the Secretary of the Department of Housing and Community Development (DHCD). The areas are first declared by the city, town, or county government. The local declarations are then submitted to the State for concurrence. If the submitted neighborhood is approved by the Secretary of DHCD, it is placed on a list of official Designated Neighborhoods and is made eligible for State targeted funding programs.

Although all incorporated cities and towns are Priority Funding Areas under the 1997 Smart Growth Initiative, this does not automatically qualify these jurisdictions as Designated Neighborhoods. Most often a Designated Neighborhood will be a small portion of a town, city, or county which is showing clear signs of distress. Jurisdictions are not limited to just one Designated Neighborhood if more than one is needed and can be justified.

26.2.9 Brownfields

Custodian: Department of Business and Economic Development

Description: Brownfields are abandoned or underutilized industrial or commercial sites, located primarily in urban areas, that are either contaminated or perceived to be contaminated. In order to encourage the cleanup and redevelopment of industrial and commercial properties in Maryland, the Voluntary Cleanup and Brownfields Revitalization Incentive Programs were established in February 1997 as part of Governor Glendening's Smart Growth policy. These programs are intended to promote economic development, especially in distressed urban areas, by creating new job opportunities, expanding the tax base, utilizing the existing infrastructure and preventing urban sprawl.

The Voluntary Cleanup Program (VCP), administered by the Maryland Department of the Environment, streamlines the environmental cleanup process for sites, usually industrial or commercial properties, that are contaminated, or perceived to be contaminated, by hazardous

substances. Developers and lenders are provided with certain limitations on liability and participants in the program are provided certainty in the process by knowing exactly what will be required. The Brownfields Revitalization Incentive Program, managed by the Department of Business and Economic Development, provides economic incentives such as loans, grants, and property tax credits to clean up and develop certain properties.

26.2.10 Heritage Areas

Custodian: Maryland Department of Housing & Community Development/
Maryland Heritage Areas Authority

Description: House Bill 1, entitled "Heritage Preservation and Tourism Areas," passed both houses of the Maryland General Assembly on April 8, 1996 and was signed by Governor Glendening on May 23, 1996. This legislation created a new Maryland System of Heritage Areas which became effective on October 1, 1996. The intent of the program is to build upon Maryland's potential for "heritage tourism" which promotes historic preservation and areas of natural beauty to stimulate the creation of new businesses and generate sales, income, and
property tax revenues for the State and local jurisdictions. This program will be overseen by the Maryland Heritage Areas Authority, established as an independent government unit operating in the Department of Housing and Community Development.

26.2.11 Designated Rural Legacy Areas by Fiscal Year

Custodian: Department of Natural Resources/Chesapeake & Coastal Watershed Service

Description: In 1997, the Maryland General Assembly approved the Rural Legacy Program as a major component of Governor Glendening's Smart Growth and Neighborhood Conservation Initiative. The purpose of the Rural Legacy Program is to protect Maryland's best remaining rural landscapes and natural areas through the purchase of land or conservation easements. The Rural Legacy Initiative is a "bottom up" program that must be initiated or endorsed by the appropriate local governments. Often, local governments work in cooperation with land trusts and individual citizens to identify Rural Legacy Areas. Digital files representing the Rural Legacy application areas by Fiscal Year were compiled and prepared by the Maryland Department of Natural Resources, with assistance from the Maryland Department of Planning and many of the applicants. The scale of the source material varied, but the database is considered accurate at a scale of 1:24,000. These files are used to produce various maps used by the application review teams, the Rural Legacy Advisory Board, the Rural Legacy Board, the Board of Public Works, and for media events announcing the funded applications.

26.3 New Product Specification: The I-Team recommends production of an entirely new series of Smart Growth data products at 1:2,400 scale. A Regional Action Team will be assigned by MSGIC to work with the existing data custodians, the Office of Smart Growth and the National Center for Smart Growth Education and Research. The Team will determine the most appropriate specifications and attribution for the new product.

26.4 Responsibility for Statewide Production or Acquisition: The Regional Action Team will work with the Geographic Data Partnership Office and custodial agencies to identify appropriate allocation of funds and responsibility for mapping each of these layers. In many cases

these layers represent programmatic activities that require frequent updating and would, therefore, be most appropriately produced by those agencies.

26.5 Cost and Procurement Options: The I-Team estimates that approximately $350,000.00 per year will be required to support production and maintenance of the Smart Growth Data Suite.

26.6 Funding Options: The I-Team recommends allocation of approximately $350,000.00 per year to support these mapping activities on an on-going basis.

27.0 100-YEAR FLOOD PLAIN DATA PROFILE

General Discussion:

Existing Product:

New Product Specification:

Responsibility for Statewide Production or Acquisition:

Cost and Procurement Options:

Funding Options:

28.0 SURGO SOIL MAP DATA PROFILE

General Discussion:

Existing Product:

New Product Specification:

Responsibility for Statewide Production or Acquisition:

Cost and Procurement Options:

Funding Options:

29.0 DEMOGRAPHIC DATA PROFILE

General Discussion:

Existing Product:

New Product Specification:

Responsibility for Statewide Production or Acquisition:

Cost and Procurement Options:

Funding Options:

30.0 COMMUNICATIONS FACILITIES AND INFRASTRUCTURE DATA PROFILE

General Discussion:

Existing Product:

New Product Specification:

Responsibility for Statewide Production or Acquisition:

Cost and Procurement Options:

Funding Options:

31.0 FACILITIES AND INFRASTRUCTURE DATA PROFILE

General Discussion:

Existing Product:

New Product Specification:

Responsibility for Statewide Production or Acquisition:

Cost and Procurement Options:

Funding Options:

32.0 WILDLIFE HABITAT AREA DATA PROFILE

General Discussion:

Existing Product:

New Product Specification:

Responsibility for Statewide Production or Acquisition:

Cost and Procurement Options:

Funding Options:

33.0 ROAD CENTERLINE/ADDRESS DATA PROFILE

General Discussion:

Existing Product:

New Product Specification:

Responsibility for Statewide Production or Acquisition:

Cost and Procurement Options:

Funding Options:

Attachment A
Four Pages

IMPLEMENTING A NEW PARADIGM

An Outcome of OMB's Information Initiative
"Collecting Information in the Information Age"

BACKGROUND

Governments at all levels (federal, state, local, and tribal) manage complex natural and social environments. They build streets, schools and airports; protect public health and the environment; and provide for public safety and disaster relief. Legislative bodies, executive branch decision-makers, and private sector businesses require accurate information about the communities, people, businesses and habitats affecting and affected by their decisions. This information about buildings, forests, waterways, weather, crime patterns, disease outbreaks, and traffic patterns is spatial data.

Spatial data has long been part of government and business processes, but its value and ubiquity are only now becoming universally recognized because of new technology that can handle large volumes of data and interoperability standards. Approximately 80% of all data used in business and government has a locational component. Much of this information has been developed over the past 30 years to serve narrow parochial missions (such as repairing streets, assessing property taxes, or dispatching emergency services). Little of it is integrated and anchored to other geographic information. With the Internet's distributed architecture and the Web's browsing and display capability, users inside and outside of government are demanding increased data pooling and sharing, based on market-driven interoperability standards.

There are a vast number of applications for geospatial data that would help Government make better decisions, conduct better operations, provide better customer service, and be more ac-countable. Banks, utilities, insurance companies, police departments, and other public and private sector organizations increasingly find new uses for location-based services, remote sensing, GPS and other technologies to serve citizens and customers better.

The Federal Government has a lead role to play in coordinating the development, access and use of spatial information. This role requires Federal agencies to exercise leadership and co-operate with State, Local and Tribal authorities, the private sector, and academia to develop a coordinated "National Spatial Data Infrastructure" (NSDI). An NSDI integrated across jurisdictions can be a key component for enabling E-Government and E-Commerce to flourish.

Historically, government budget authorities treated spatial data and its supporting infrastructure as data processing expenses to be funded from current year operating budgets. However, as spatial applications began to extend into nearly every aspect of our lives, they began to cut across organization lines and exceed the capacities of single department missions and budgets. Like the national road system, each level of government has an appropriate role, as does the private sector. No one agency or level or government can or should build or fund its spatial data and decision support needs alone.

Spatial Infrastructure has become an essential part of the nation's capital infrastructure. Despite this fact, no widespread capital financing model for GIS has emerged. Spatial infrastructure, an intergovernmental capital asset, continues to be funded by "stovepiped" annual appropriations. This mismatch between the need for long-term capital financing and the current reliance on annual appropriations remains one of the chief obstacles to the attainment of the NSDI.

Government entities at all levels, as well as private sector organizations, are making major investments in spatial data needed for operations. They fulfill governmental data mandates supporting essential public services and policy goals (such as clean air and water, efficient transportation, safe streets, emergency relief, and urban and rural sustainability). The costs of data stewardship for municipalities, water districts, and other local, state and tribal government organizations are significant. The challenge for all levels of government is to develop common criteria for spatial infrastructure investments, align annual public and private budget cycles more effectively, and pool and leverage spatial investments.

In addition, if spatial data is an important part of the nation's information infrastructure, it should be constructed, maintained, renewed, and budgeted for over its long-term life cycle as any other critical capital asset. Alternative financing mechanisms to the current annual appropriation "stovepipes" are needed.

A NEW PARADIGM EMERGES

We have an historic opportunity for all levels of government, and the private and nonprofit sectors to establish a new paradigm.

Partnerships among State, local, Tribal, and Federal authorities, and the private sector could help share costs by capturing economies of scale and aligning their pooled capital investments in standardized spatial data layers and content.

Mechanisms for allocating and sharing data collections and costs efficiently effectively and fairly would encourage data development and stewardship at the right place by the right organization.

All investors in spatial infrastructure should use common criteria when investing in spatial infrastructure. Criteria would include Federal and market standards for interoperability, data format, and metadata and content standards, along with principles for public access, data security, privacy and other goals affecting governmental and business data.

Creative financing outside of government appropriation cycles, such as infrastructure bonds or other financial products, could supplement and de-politicize the funding process, providing the liquidity to deploy and sustain shared spatial infrastructure.

In this paradigm, no Federal program or initiative needs to dictate policy to States, local, and tribal jurisdictions, or the private sector, for the NSDI to develop. Rather, all parties collaborate as partners in consortia operating in states, regions, industries or interest groups. This strategy implements the NSDI by aligning spatial infrastructure investments using common investment criteria.

IMPLEMENTING THE NEW PARADIGM

As part of OMB's Information Initiative "Collecting Information in the Information Age", OMB recently completed a series of public Roundtables exploring how to improve the quality of the spatial data Government collects while minimizing the collection burden. Dialogue focused on the need to overcome the financial and institutional barriers to the sharing of spatial information among Federal, State, local, and tribal entities, and the private sector. In response to participants' recommendations, OMB (in cooperation with the Federal Geographic Data Committee (FGDC), National Performance Review (NPR), Council for Excellence in Government, Urban Logic, and other public and private sector stakeholders) has invited the spatial data community to begin several implementation actions.

Implementation Teams (I-Teams). I-Teams will organize institutions in their state or region to build statewide portions of the NSDI. Already, New Jersey, Kentucky, North Carolina, Oregon and Metropolitan New York City have committed to establish an I-Team. Each Team, aligning the needs and resources of its State, local, tribal, Federal, and private sector partners, will prepare a comprehensive plan for compiling, maintaining, and financing spatial infrastructure in its Team area. It will identify the needs and responsibilities of the partners, align and leverage resources, and establish detailed timetables and performance measures.

A Federal Partners Team. Consisting of senior officials of OMB, FGDC, USGS, NOS/NGS, Census, DOT, BLM, NRCS, and EPA, and other interested agencies. The Federal Partners Team will focus Federal agency efforts, respond to and coordinate with I-Teams, and explore new alternatives to develop needed standards.

A Financing Solutions Team (FSTeam). The FSTeam will identify and recommend inter-governmental and public-private financing alternatives to support the NSDI and the I-Teams.

A Technology Advisory Group (TAG). Open to all vendors and led by the Open GIS Consortium, TAG will be a resource for I-Teams. It will keep I-Teams and Federal Partners informed of technology innovations and be available to solve common technology challenges. By working with I-Teams to develop and test new products and solutions, TAG will accelerate dissemination of knowledge of the substance and process of building interoperable networks and open systems. TAG also will help the FSTeam use standards to develop strategies for procurement, budgeting and capital pooling.

The Financing Solutions Team

The FSTeam will act as investment advisors to the I-Teams and the Federal Partners. It will research and structure ways to improve how spatial infrastructure investments originate, perform and align.

Make A Business Case. The FSTeam will develop a business case, value proposition and financing options for the I-Teams and Federal Partners to use in preparing their working plans and budget proposals. It will help the geospatial community to explain to legislative bodies the benefits of aligning investments to achieve the NSDI.

Explore Better Use of Existing Appropriations Structure. Currently, almost all spatial information budget processing is annual. The FSTeam will explore better ways to fund spatial infrastructure investments by aligning and optimizing appropriations, budget, and procurement cycles at all levels of government, including interagency and cross-cutting mechanisms. It will analyze cash flows and

returns on investment, and compare costs and benefits. It will develop common investment criteria and explore ways to pool and leverage spatial investments.

Suggest New Funding Mechanisms. The FSTeam will use the cash flows, preliminary investment criteria and other results generated by its research and work to design sustainable capital financing options, such as infrastructure bonds or revolving funds. In the case of other national infrastructure and community development activities (such as roads, housing stock, airports, and small business development) the Federal government has used financial intermediaries (such as state bond banks, Fannie Mae, Community Development Corporations, and Small Business Investment Companies) to pool and administer local public and private resources through national investment criteria.

Electronic meeting support, knowledge management and other Web-based collaboration tools will be available to members of the FSTeam. This should minimize the need for face-to-face meetings, conserve the valuable time of its distinguished members, and begin the process of creating a public and private financing toolkit.

Legislation or executive guidance may be needed to authorize specific plan elements (for in-stance, public and private financial incentives that support the long-term sustainability and value proposition of the NSDI). In such cases, the FSTeam will provide the I-Teams and Federal Partners with suggestions for legislation, executive guidance and supporting documentation reflecting the knowledge of all Teams.

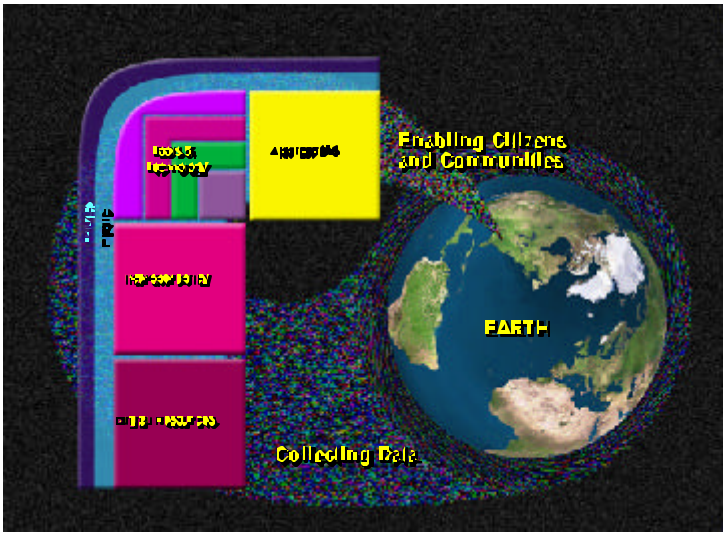
Attachment B
Four Pages

What is Digital Earth?
By the Digital Earth Office at NASA Goddard

Society has gathered an enormous amount of digital information about the Earth and its inhabitants. This digital information consists of everything from satellite photographs that detail cities and farm fields to databases containing information on transportation, commerce, population, crime, food production, history, and much more. The scale ranges from global to local--from humanity to the individual. This information that is stored around the world is not easily accessible or easily utilized in conjunction with other types of data.

Recognizing this challenge the *National Digital Earth Initiative* was created to enable and facilitate the evolution of Digital Earth, a digital representation of the planet that will allow people to explore and interact with vast amounts of natural and cultural information. Imagine a school child able to browse the planet, requesting information on land cover, distribution of planet and animal species, real-time weather, roads, political boundaries, and population. Imagine the quality of decisions that we could make as citizens, community leaders, business executives, and government leaders if we could seamlessly integrate information about our world from multiple sources.

Digital Earth is several things: a way to obtain information about the Earth; a framework in which to publish information; a new market for data, software and services; a set of standards; a local, national, and international collaboration; a near-term "alpha version"; technology challenges for the long-term vision. A primary goal of Digital Earth is to unlock the world's knowledge by simplifying access to georeferenced information, which is information that relates to a particular spot or area of the earth. The benefits will include reduced costs, a broadened range of users, enhanced merging of data from different sources, and improved decision-making by citizens, businesses and government.



Digital Earth provides an environment for everyone to access and employ the vast amounts of cultural and physical electronic data that exists about the Earth. This data resides in many Digital

Resources around the world. An Interoperable environment is needed for Tools and Technologies to access and exploit these data archives. Tools and Technology range from generic items in the information technology marketplace to developments for specific Applications. Education, decision support, resource management, problem solving for citizens and communities are some of the many applications available through Digital Earth.

Digital Resources data, that constitute the raw materials of Digital Earth, are created and stored in many different ways. Large volumes of data are collected through various measurement methods at all geographic locations, e.g., direct measurements and remote sensing. Human activities and studies generate data with geographic components. Other data is the result of studies or activities that have an implied geographic relevance. This data includes natural and cultural themes, e.g., environmental, social, historical, government, economic, earth science, space science. All of this data is stored as a variety of Digital Resources.

Interoperability is the capacity to access multiple resources through common approaches to allow interaction of the wide variety of information technologies. Interoperability is defined in standards, through agreement on terminology; adoption of defined protocols, and through distributed services on the Internet. Interoperability allows simultaneous use of multiple geo-spatial data sets without needing to change the underlying digital resources. As users request data from multiple digital resources the interoperability is apparent as the responses from each of the various digital resources can be combined in a standard Web Browser. This allows a user to request land, water and political boundary data from different sources and overlay the data with geographic accuracy, producing a product specific to the user's application.

Tools & Technology are needed to allow users to enhance the data appropriately for their specific applications. Mature systems currently exist for management of the Digital Resources and to support the primary users of the data. The emphasis of Digital Earth is on the secondary users of the data, people who were not involved in the collection of the data, but can use the raw data for their particular purposes. Some of the tools and technologies to exploit the data exist today and others need to be developed. Standards and metadata for interoperability, Web Mapping, interactive 3-D visualization, storage and access of large multi-resolution datasets are some of the many tools and technologies.

Applications are where the value of Digital Earth is demonstrated. Imagine a social studies class learning about westward expansion across North America being able to access any relevant geo-spatial data and overlay that data to clearly visualize the topic. Another scenario might be a State Disaster Team response to an emergency in which they can access and utilize data showing the immediate area, the surrounding area, the weather and any other pertinent information. The public will determine the extent to which Digital Earth Applications develop.

Digital Earth is currently accessible to the end user, for general purposes, over the Web. In addition, high-performance access (for example, three-dimensional virtual reality displays) will be available at fixed installations in museums, libraries or educational institutions. Through Digital Earth, as with the World Wide Web, some information will be available with no charge and other data will have a fee. As a user of Digital Earth you will be able to rapidly find and retrieve relevant information through Catalogs, Portals and support services.

Once the desired information has been found, the user will be able to explore it by zooming in from global to local views, roaming through space and time, and asking for additional information on particular features. Furthermore, it will be possible to overlay information from different sources

to obtain knowledge and make decisions. Currently, web-based map services exist, but each one contains only some fraction of the total information available and each has a different user interface. Digital Earth will enable a network of data servers that use common protocols; as a result, the user will choose the interface that suits his or her needs and be able to obtain information from any server. As an analogy, consider the World Wide Web (WWW), which lets users choose the brand of web browser they prefer and to access text and multimedia content from any web site.

The Provider in a Digital Earth Environment enables you to publish information in an *open framework*. "Open" means that the standards for the framework are publicly available, defined and modified by consensus processes, and can be implemented without requiring a particular brand of software or hardware. Within that framework, you will be able to give away your information, or sell it, or restrict access as needed.

By participating in this framework, you will maximize the audience for your information because it is compatible with that of others. By analogy, nearly all businesses today offer enterprise information and service using the WWW framework rather than customized applications. This has reduced costs for businesses providing text-based information in the same way that Digital Earth will reduce the costs of providing geospatial information.

As a software or service provider, there will be a market for intermediary services or application-specific software atop this open framework. Examples include data server software allowing collections of data to be easily put on-line, conversion services that translate between formats and coordinate systems, and value-adding or aggregation services. The standards may be public, but there will be a market for commercial software with documentation and customer support. You will maximize the utility of your applications because they will be applicable to more than a single collection of data.

Within the US, relationships are being established between federal, state, local and tribal governments, between government and the commercial and academic sectors, and within agencies of government. Affiliations are being established internationally as well. The National Aeronautics and Space Administration (NASA) has been identified as the lead agency. *NASA's Digital Earth Office* performs secretariat functions for the national Digital Earth Initiative and aligns NASA's data and resources with the national initiative. Many US government agencies work together within the Digital Earth Steering Committee and the Interagency Digital Earth Workshop to determine the government's needs and positions.

The Digital Earth Initiative is establishing relationships with NSGIC and NACo to coordinate with relevant activities. The United Nations Environmental Program has been considering a Global Digital Earth (GDE) collaboration, and several other countries have Digital Earth activities, e.g., China, Canada, European Commission, and Israel.

In addressing the question what is Digital Earth we have touched on every aspect of the Digital Earth Program, including vision, environment, initiative, and involvement from many sources. The Digital Earth *Vision* is to provide Interoperability of geo-referenced digital resources. Digital Earth supports decision-making, geo-information management, increasing knowledge, and scientific discovery and dissemination to support a sustainable human world. Digital Earth is accomplished through a spirit of collaborations that enables involvement of the individual. Digital Earth *Environment* is the technical, managerial, and application guidelines to facilitate a Digital Earth. The Digital Earth *Initiative* is a multi-agency collaboration that enables and facilitates the evolution of a

Digital Earth. The initiative demonstrates implementation through public and private partnerships. Together with community, public, and private partnerships Digital Earth will facilitate an environment for anyone, anywhere to access and use geo-spatial data to its full potential.
For additional information see the national web page at *www.digitalearth.gov*

Attachment C
Three Pages

Annotated Code of Maryland
State Government Article
Sections 10-901 through 10-905, inclusive
Unofficial Version - Do Not Use for Legal Purposes

§ 10-901.

(a) In this subtitle the following words have the meanings indicated.

(b) "Cost of providing a system product" means the cost to create, develop, and reproduce the product in printed or hard copy form.

(c) "Cost of providing a system service" means the actual cost of providing the service, including a reasonable share of the overhead costs of the system.

(d) "Governmental unit" means:
(1) the State or a political subdivision, unit, or instrumentality of the State;
(2) a unit or instrumentality of a political subdivision of the State;
(3) a bicounty agency; or
(4) a combination of the entities specified in items (1) through (3) of this subsection.

(e) "Overhead costs of the system" includes the costs of:
(1) data gathering and entry;
(2) data base maintenance and update;
(3) hardware;
(4) quality control;
(5) software; and
(6) indirect costs.

(f) (1) "System" means an automated mapping-geographic information system in which geographically referenced data:
(i) are entered and stored electronically; and
(ii) can be manipulated to display selected geographic data.
(2) "System" includes data that define physical and nonphysical elements of geographically referenced areas.

(g) "System products" means drawings, lists, maps, narrative descriptions, photographs, or other hard copy formats that depict spatial data.

(h) "System services" means:
(1) electronic access to data in the system;
(2) on-line access to data in the system; and
(3) software programs to access data in the system.

§ 10-902.

The General Assembly finds that:

(1) automated mapping-geographic information system products and system services have value to the general public; and

(2) automated mapping-geographic information system services that are developed at public expense should not be unreasonably withheld from private commercial users of geographic information, but should not provide a public subsidy to private commercial users.

§ 10-903.

(a) This subtitle is applicable to a system established or maintained by any governmental unit.

(b) Except as otherwise provided in this subtitle, to the extent of any inconsistency, §§ 10-611 through 10-628 of this article do not apply to this subtitle.

§ 10-904.

(a) A governmental unit may adopt a fee structure for:
(1) system products that will:
(i) make system products available at a cost consistent with the requirements of this subtitle; and
(ii) cover the cost of providing system products; and
(2) system services that:
(i) will cover the cost of providing system services, including a reasonable share of the overhead costs of the system; and
(ii) will not discriminate among purchasers of system services.

(b) A governmental unit may sell system products to the general public for a fee that reasonably reflects the cost of creating, developing, and reproducing the product in whatever format is available.

(c) A governmental unit may sell system services to the general public, subject to subsection (d) of this section, for a fee that reflects the cost of providing the system services.

(d) A governmental unit:
(1) may reduce or waive the fees that it charges for system products and system services that are to be used for a public purpose; and
(2) shall apply its reduction or waiver of the fees uniformly among persons who are similarly situated.

§ 10-905.

(a) Only a person who has entered into a contract with a governmental unit may have on-line access to the geographic data in a system under the terms of the contract.

(b) If copy privileges are granted, the contract shall specify in addition to other conditions as may be required:
(1) the circumstances and conditions under which data can be copied; and
(2) the amount of compensation the governmental unit will receive for this privilege.

(c) On-line access:
(1) shall be limited to read; and
(2) may not include:
(i) the ability to enter, alter, or delete data; or
(ii) access to information that would be denied under §§ 10-615 through 10-619 of this article.

Attachment D
Two Pages
Standard License Agreement

[Insert Department Name Here]
[Insert Unit Name Here]
Spatial Data Order Form and License Agreement

THIS LICENSE AGREEMENT is made by the [Insert Department and Unit Name Here], hereinafter called Licensor, and the Purchaser of spatial data identified on page 1 of this License Agreement, hereinafter called Licensee.

Under State Government Article, Sections 10-901 et seq., of the Annotated Code of Maryland, Licensor is the owner and/or custodian of the geographic information system data listed on page 1 of this License Agreement, hereinafter called Spatial Data. Licensor may disclose and reproduce Spatial Data and charge fees for its products and services.

Licensee wants the non-exclusive right to use Licensor's Spatial Data.

IN CONSIDERATION of the mutual conditions in this License Agreement, Licensor and Licensee agree as follows:

1. SCOPE OF LICENSE

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